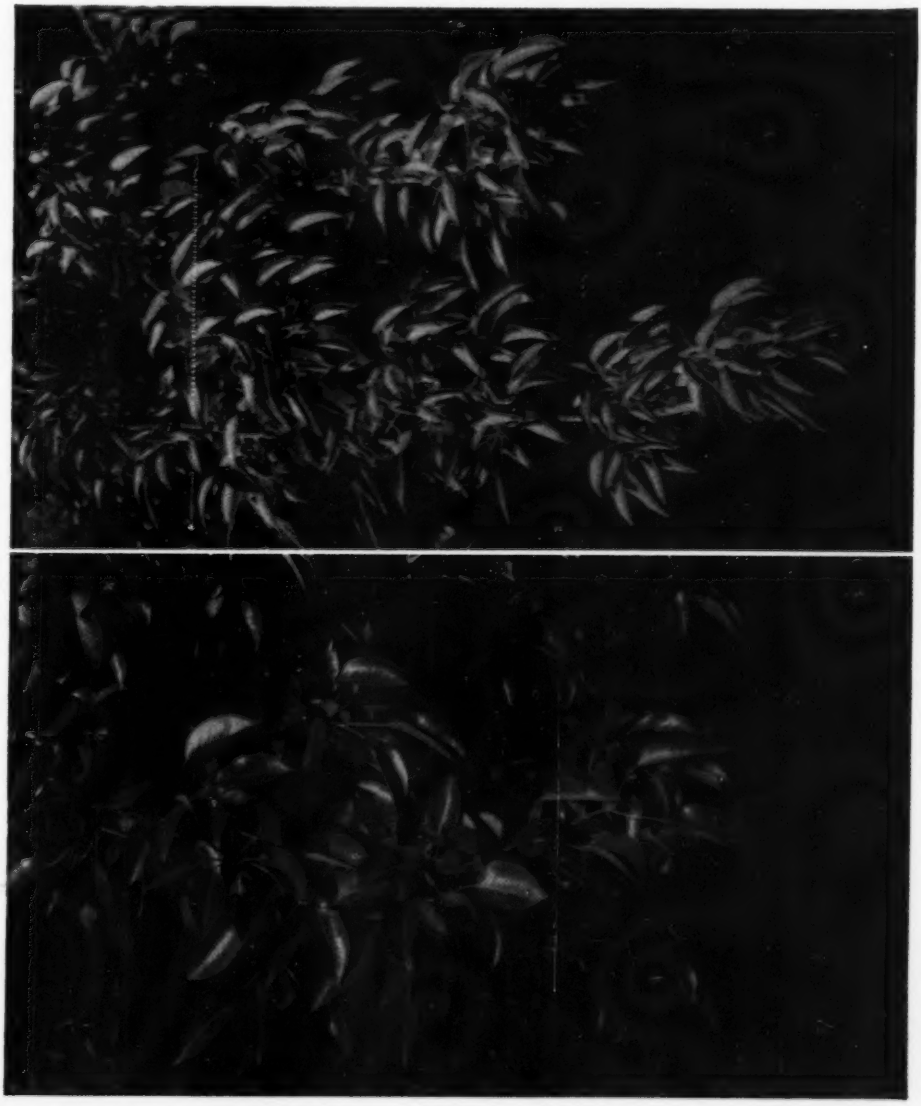
Better Crops WITH PLANT FOOD

October, 1957 10 Cents



Pear trees are hardy—but can suffer from potash hunger

The following article reprints on profitable soil and crop management are available on request. Please indicate the reprint code and the number you desire. The address is: American Potash Institute, 1102 16th Street, N. W., Washington 6, D. C.

SOIL AND PLANT ANALYSIS

Y-5-43	Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
CC-12-52	The Leaf Analysis Approach to Crop Nutrition
DD-10-53	Sampling Soils for Chemical Tests
K-2-54	Soil and Plant Analyses Increase Fertilizer Efficiency
JJ-10-54	Principles Involved in Soil Testing

FORAGE CROPS

Z-5-45	Alfalfa—The Aristocrat
II-12-51	Pasture Improvement with 10-10-10 Fertilizer
I-2-53	Sericea Is a Good Drought Crop
N-4-53	Coastal Bermuda — A Triple-threat Grass on the Cattleman's Team
T-5-53	Trefoil Is Different
II-11-53	The Importance of Legumes in Dairy Pastures

GENERAL FIELD CROPS

A-1-52	Research Points the Way to Higher Levels of Peanut Production
Y-10-52	The Nutrition of Muck Crops
J-3-53	Balanced Nutrition Improves Winter Wheat Root Survival
P-4-53	Learning How to Make Profits from Sweet Potatoes
U-4-54	Nutrient Balance Affects Corn Yield and Stalk Strength
LL-10-54	Relation of Fertilizer to Quality and Yield of Flue-cured Tobacco
C-1-55	Summary of Ten Years' Work with Complete Fertilizers on Sugar Cane

VEGETABLE CROPS

SS-12-49	Fertilizing Vegetable Crops
SS-11-54	Foliar Application of Plant Nutrients to Vegetable Crops

FRUIT AND NUT CROPS

P-3-45	Balanced Fertility in the Orchard
BB-8-50	Trends in Soil Management of Peach Orchards
X-8-51	Orchard Fertilization Ground and Foliage
EE-8-54	Red Apples Require Balanced Nutrition
J-4-56	The Relation of Potassium to Fruit Size in Oranges

SOILS AND FERTILIZER—GENERAL

3-1-56	Potash in Agriculture
A-1-44	What's in That Fertilizer Bag?
T-4-46	Potash Losses on the Dairy Farm
TT-11-47	How Different Plant Nutrients Influence Plant Growth
AA-6-48	The Chemical Composition of Agricultural Potash Salts
JJ-11-53	Boron—Important to Crops
R-3-54	Soil Fertility (Basis for High Crop Production)
YY-12-54	Physical Condition of the Soil Affects Fertilizer Utilization
D-1-55	Nitrogen Use Accentuates Need for Minerals

GENERAL

S-5-40	What Is the Matter with Your Soil?
Y-5-46	Learn Hunger Signs of Crops
GG-10-48	Starved Plants Show Their Hunger
BB-10-51	Healthy Plants Must Be Well Nourished
KK-12-51	Potassium in Animal Nutrition
CC-6-54	Fertility Increases Efficiency of Soil Moisture
A-1-55	Potash-Deficiency Symptoms

ON THE COVER . . .

. . . leaves from two different Bartlett pear trees show signs of hunger and health.

The pale green leaves above are suffering from potash hunger. They are curled up. Their margins are scorched dark brown. Their shoot growth is stunted. They are smaller than healthy leaves. Such leaves usually have only 0.2% to 0.4% potassium when analyzed.

The rich green leaves below are healthy from balanced fertilization. They received the nitrogen, phosphate, potassium, boron, iron, magnesium and all the other elements that make a healthy pear tree. Such normal appearing leaves usually have 0.75% potassium or higher.

In their article (page 8) on fertilizer studies with fruits, Cornell Pomologists E. G. Fisher, D. Boynton, and J. D. Kirkpatrick report pear, apple, and sour cherry orchards, as well as grape vineyards, in western New York "would profit from additional potassium fertilization."

Studying the effects of potash application on fruit size of Bartlett pears, the pomologists observed "potassium resulted in larger, greener, less mature fruit at harvest."

Such fruit, it seems, is well fitted to meet the shipment and storage problems of today's growing markets.

The pear is considered a hardy fruit that will stand such adverse conditions as poorly drained soils and wide extremes of heat and cold. It is not unusual to see growing on old farmsteads pear trees estimated to be 75 to 100 years old.

But, with all this sturdiness, the pear that does not get sufficient amounts of the essential plant foods—NPK—begins to lose its size, its storage qualities, its flavor, its market appeal—in other words, its health.

Through such programs as the Cornell Orchard Diagnostic Service, more and more fruit farmers can determine the nutritional needs of their orchards and convert those needs into healthy, profitable crops.

Better Crops with PLANT FOOD

The Whole Truth
Not Selected Truth

SANTFORD MARTIN, JR., *Editor*

Editorial Office:
1102 16th Street, N. W.
Washington 6, D. C.

OCTOBER 1957
VOLUME XLI
NO. 8

The American Potash Institute, Inc.

1102 16th Street, N. W.
Washington 6, D. C.

Washington Staff

H. B. Mann, *President*
J. W. Turrentine, *President Emeritus*
J. D. Romaine, *Vice Pres. and Sec'y*
S. W. Martin, Jr., *Publications*
Mrs. H. N. Hudgins, *Librarian*

Branch Managers

E. T. York, Jr., *Washington, D. C.*
J. F. Reed, *Atlanta, Ga.*
W. L. Nelson, *Lafayette, Ind.*
M. E. McCollam, *San Jose, Calif.*
R. P. Pennington, *Burlington, Ont.*

Member Companies

American Potash & Chemical Corporation

•

Duval Sulphur & Potash Company

•

Potash Company of America

•

Southwest Potash Corporation

•

United States Potash Company
Division of United States Borax & Chemical Corporation

CONTENTS
FOR THIS ISSUE

Dakota Homestead 3
By Jeff McDermid

Diagnosing Fruit Needs 8
By E. G. Fisher, D. Boynton, and J. D. Kirkpatrick

Growing Interest in Pine Tree Fertilization 15
By Howard Parker

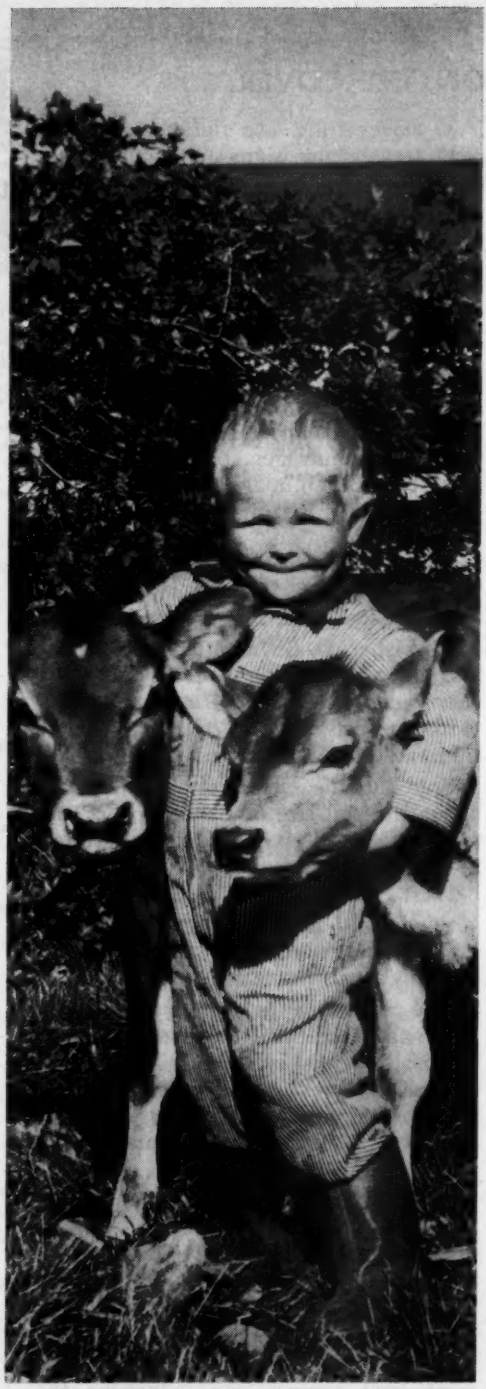
Fall Fertilizing Pays Off 16
By C. J. Chapman

Agriculture, The Great Adventure—III 24

Using Soil Test Summaries 26
By W. F. Bennett and J. J. Hanway

Give Johnsongrass A Break . . . Fertilize It 32
By C. Dale Hoover

Salts of the Earth 38
By Erwin J. Benne



Mine!

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1102 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1957, BY THE AMERICAN POTASH INSTITUTE, INC.

VOL. XLI WASHINGTON, D. C., OCTOBER 1957 No. 8

Fifty Years Ago on That . . .

DAKOTA HOMESTEAD

Jeff McDermid

(ELWOOD R. MCINTYRE)

Father filed on a homestead claim back in 1907. Mother and I first saw the little clapboard shack on the west Dakota prairie late one bright autumn day. It was our first taste of western life on the "lone pray-ree." Father had taken the claim under veterans' rights, and he was our forerunner and arranger.

For several years he would relate his war experiences and privations to us, always vowing to make good some day on his legal right to acquire a parcel of land for the small cost of residing there and plowing a few furrows inside the barb-wire fences. At 66 years he had no time to waste, wanting to establish residence for two years and then get title at a nominal cost of $1.25 per acre.

He yearned to be an elderly argonaut to the western Eldorado. We ourselves gradually became imbued with a dash of his infection for adventure. It would mean no great change in latitude to make this migration. But it would indeed be a change of scene. From our native land of rolling meadows, timbered hills, sparkling lakes and streams we would move to high and dry plateaus, minus many natural waterways, bounded on the top by the clouds and the stars, fringed on all sides by vibrating mirages and brown, endless, treeless distances. The drier atmosphere was supposed to banish colds and seeping sinuses and impart a leathery,

shiny windblown complexion.

In our planning little comment was made about the dismal existence on a claim in a makeshift shack, frequented by field mice and other night vermin that penetrated the mattresses. Nor did we mention our claim shack would be exposed to the brilliant sun, whose rays scorched and bent the tar paper roofing. The small detail of good well water was glossed over, too, a point I paid for later by lugging splashing pailsful a mile or more from the nearest neighbor's claim, using a neck-yoke device while the voracious mosquitoes devoured my face and hands as I stumbled through the bunch grass.

Our journey by rail through Fort Pierre and westward included a ferry across the Missouri and more rattling travel out to the railroad's current terminal at Philip. Here we stayed in a hostelry reminiscent of old Virginia City days—all bunks filled with construction crews. The next day we boarded a six-horse stage to jump the gap by overland trail to the connecting town on the western end of the line.

This lumbering Deadwood type of coach and its laconic driver thrilled me no end. Only three summers before I had seen the dramatic stage coach robbery enacted by the Sioux Indians of William F. Cody's own historical pageant, where the famous Annie Oakley shot on the wing from a prancing broncho. The coach we rode was exactly like it. And no tenderfoot ever had a worse case of tension and elation than myself, perched beside the driver in front, with Mother and the trunk and pine packing boxes careening along behind.

"THROUGH THE PRAIRIE DUST . . .

Jolting over the rough terrain with my blue graduate suit and stiff derby hat, my presence must have been a real temptation for our rugged driver to initiate me into the ways of the West. He was not very communicative. But his brief answers were tuned to the occasion, including the hint that homesteaders were interlopers with stacks of hostility waiting for them from old-time ranchmen and cow-punchers who hated furrows and fences as a direct violation of the open range.

The vastness of the grassy seas we were traversing caused me to reply there seemed ample room out there for more beef and wheat than the country could easily consume. This sage forecast was made long before any government price supports and acreage allotments were ever dreamed of in political philosophy.

Perhaps our driver himself could see ahead of us through the prairie dust to the days when progress would shift much of his native scenery and customs for him—when these same homesteaders would be raising drought-resistant grain and thronging the towns for movies and gadgets; and the Black Hills country would be full of gas stations, hotels, and garages to accommodate eastern motorists, whose high-powered cars would no longer ford the winding Teton river, or be halted and detoured by the pinnacles and desolate gorges of the Badlands.

Maybe he thought there was an undying permanence to such legends as Bill Hickok, Calamity Jane, Corbin Morse and his fabulous ranch, Bat

Masterson, and the noted Indian braves, Sitting Bull and Red Cloud (Pashuta Luta). But he didn't reckon on the great stone faces to be on Rushmore Mountain, or the kind of highwaymen that lay roads instead of waylaying travelers.

Well, in due time our lumbering stage brought us to Owanka, our humble destination, meaning a "place to camp," situated on meandering Box Elder Creek. This little hamlet still survives, but the main concrete trunk highway runs far northward of the site where traders and railway leaders built the rude wooden stores with high false fronts, the red section master's house, and the boxlike depot.

Dad met us at the depot with a team and wagon he had borrowed from a neighbor. We piled in with stiff joints and started off with our small baggage box and the dog who would not be left behind—all heaving up that gravelly hill road to the upland prairie beyond the valley. It was just a narrow, aimless trail between a few barb-wire fences, leading to our shack adjacent to the Beam schoolhouse—a district institution which had served a sparse population of youngsters since the settlers took over the region from the red men in the seventies.

It might be well at this point to declare fervently that ranch families like the Beams and their friends never once molested or belittled us, contrary to the premonitions of the sallow stage driver. They even invited us to their roundups and anniversary parties, and advised us on building cave cellars and digging wells.

. . . TO OWANKA, 'A PLACE TO CAMP' "

It's odd how we remember the little things and forget the big ones. I can't tell you about the township officers, the details of ranching operations there, or the cost of groceries in that far-off claim era at the turn of the century.

But I do recall how weary Mother was when we arrived—and in no mood at her age to look on life with candid hope and vivid reality, even had that lonely spot been bedecked with prairie flowers for her welcome. She climbed down and dragged her tired feet through the little south doorway, where a mail-order stove was waiting for somebody's home economics; where a sleazy cotton curtain on wire hooks separated the parental couch from the single bed on which my patchwork quilt was spread. Then between the living and eating section and the sleeping quarters a second curtain was strung at right angles.

The floor was of unmatched lumber and the ceiling lean-to rafters. The little abode was 16 feet east and west, 14 feet north and south. There was a little wooden step before the door and a tiny wood and kindling storehouse at the southwest corner. To the east was the "necessity" just about big enough to enter and turn around. And on the sunrise side of the shack was the customary western food storage cave, dug out of hard gumbo soil and banked over with more of the same. Tar paper covered the slanting roof and the side walls had one air space between sheathing and siding boards. What we supposed was a well had been dug a few

rods east, but casings were so unsound, platform so weak and wobbly that wild creatures had tumbled into the opening and drowned. So, for a time, we boiled every drop of water we drew.

Soon after our early retirement that first evening, yowling bedlam broke loose on the surrounding prairie—like a dozen happy youngsters on a sleigh ride. Dad assured us it was not a band of Sioux seeking revenge for stealing their land—but maybe just a couple of stray coyotes on the prowl. I dug my head under the comforter, thinking on that old schoolroom chromo of a lone wolf on the brow of a moonlit hill overlooking a lonely town. Then I suddenly felt a flutter in my hair. I clutched at a lock and grabbed a field mouse in my fist.

Yes, this was living in the rude and raw. Kit Carson, Father DeSmet, Buffalo Bill all were being reincarnated by an unprepared novice from the high school senior class of 1907. On many later moments I have acknowledged that this experience was good for what ailed me. The sameness, the monotony, the absence of many vital incentives train a youngster to be patient and serene.

Westward 30 miles, Harney's peak loomed and beckoned us, while we broke the sod and numbed our arms chucking down the hand corn planters into the tough land which resisted man's taming process. Oats grew fairly well except in the whitish alkali spots. But never did agricultural seed thrive like the native buffalo grass and sage.

My memory still brings me the charms of certain moments—the dusty ride on the Deadwood stage coach, the larks cheeping by day and the coyotes crying by night, my cow puncher chums wrestling a calf at the branding corral. When I first saw those great stone faces on Rushmore mountain a short while back, I actually looked far behind them. I was searching for certain filmy faces from the past who peopled the prairie for me in the days of my youth. I felt almost as lonely as those majestic faces must feel when the air is chill and the sun has set.

But he who knew Dakota in the old times can only be pleased at its progress today. ◄◄◄

BOOSTING ALFALFA . . . AND CALF POUNDS

ALFALFA yields were boosted more than a ton and a half per acre when lime, fertilizer and manure were added in Minnesota tests, reports Wallace Nelson, University of Minnesota agronomist.

Nelson says the fertilized alfalfa yielded 3½ tons per acre, compared to only 1.9 tons when the field received no lime, fertilizer or manure.

In other tests at the University's Duluth experiment station, renovation, lime and fertilizer increased summer gains by almost 60 per cent in dairy calves. Total gain on fertilized pasture was 395 pounds for 282 calf-grazing days, Nelson says, compared to only 250 pounds of total gain in the same number of grazing days on the non-fertilized areas.

REVIEWS

October, 1957

Recent publications of the United States Department of Agriculture, The State Experiment Stations, and Canada on Fertilizers, Soils, Crops, and Economics. Requests for publications listed should be made directly to the original source.

"1956 Minnesota Hybrid Corn Performance Trials," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 28, March 1957, E. L. Pinnell, A. F. Troyer, and E. H. Rinke.

"1957 Varieties of Farm Crops," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 22, Rev. Jan. 1957.

"Maturity Ratings for Corn Hybrids in Minnesota, 1957-58," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 20, Rev. March 1957, E. H. Rinke, A. F. Troyer, E. L. Pinnell, and N. C. Olmeim.

"Vegetable Varieties for Minnesota," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 154, Rev. March 1957, O. C. Turnquist.

"Mississippi Cotton Variety Tests for 1956," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 206, Jan. 1957, J. F. O'Kelly, S. P. Crockett, B. C. Hurt, B. C. Murphy, and R. E. Coats.

"Small Grains in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 546, Dec. 1956.

"Mustard Seed Production," Agr. Ext. Serv., Mont. State College, Bozeman, Mont., Cir. 261, March 1956, A. F. Shaw.

"Nebraska Corn Performance Tests for 1956," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 57, Nov. 1956, A. F. Dreier, J. H. Lonnquist, P. L. Ehlers, F. V. Pumphrey, and M. J. Greenwood.

"What's Wrong with My Tree?" Agr. Ext. Serv., Rutgers Univ., New Brunswick, N. J., Lflt. 156, June 1956, S. H. Davis, Jr.

"Pecan Production in New Mexico," Agr. Exp. Sta., N. Mex., A. & M. College, State College, N. Mex., Bul. 410, Oct. 1956, R. E. Harper and J. V. Enzie.

"Pinto Bean Trials," Agr. Exp. Sta., N. Mex. A. & M. College, State College, N. Mex., Bul. 411, Nov. 1956, F. A. Quinones.

"The Planting and Care of Shrubs and Trees," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 185, Rev. Sept. 1956, D. J. Bushey.

"Varieties of Fruit for New York," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 733, Rev. May 1956.

"Measured Crop Performance," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 400, June 1956, W. H. Rankin and F. W. Brittain.

"Tobacco Plant Production Guide," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 363, Dec. 1956, S. N. Hawks, F. A. Todd, and H. E. Scott.

"Flue-Cured Tobacco Varieties in North Carolina," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 302, Dec. 1956, R. R. Bennett, S. N. Hawks, and A. Perry.

"Ohio MR-200, A Mosaic-Tolerant Slicer-Type Cucumber," Agr. Exp. Sta., Wooster, Ohio, Res. Cir. 41, Feb. 1957, J. D. Wilson, C. A. John, and H. W. Wohler.

"Trends in the Ohio Strawberry Industry," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 787, Jan. 1957, M. E. Cravens and L. U. Cockroft.

"Asparagus Culture," Agr. Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Cir. 617, Oct. 1956, R. R. Clark.

"Performance of Wheat Varieties in Eastern Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Cir. of Inf. 564, Oct. 1956, C. R. Rohde, W. E. Hall, M. J. Johnson, and E. N. Hoffman.

"Progress Report, Possible New Dryland Crops in Umatilla County," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Cir. of Inf. 561, July 1956, H. M. Waddoups.

"1956 Vegetable Variety Trials," Agr. Exp. Sta., Pa. State Univ., University Park, Pa., Prog. Rpt. 166, March 1957, M. L. Odland and C. J. Noll.

"Home Garden Information for Coastal South Carolina," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 387, Rev. Jan. 1956.

"Home Garden Information for Central South Carolina," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 388, Rev. Jan. 1956.

"Home Garden Information for Piedmont South Carolina," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 389, Rev. Jan. 1956.

"In Tennessee—Peppers Pay," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Pub. 363, May 1956, J. J. Bird.

"1956 Performance Trials of Field Crop Varieties," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 256, Feb. 1957, R. H. Gibson.

"Summary of the 1956 Texas Corn Performance Tests," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1904, Nov. 1956.

"West Texas Vegetable Market Potentials—Tomatoes," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1925, Feb. 1957, L. H. Hammond and H. B. Sorensen.

"Pearl Millet Variety Tests," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1932, Feb. 1957, E. C. Holt.

"Cotton Harvest-Aid Chemical Tests in Texas, 1956," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1935, March 1957.

IN WESTERN NEW YORK

DIAGNOSING FRUIT NEEDS . . .

THE western New York fruit-growing area is located along the southern shore of Lake Ontario extending from just north of Syracuse to west of Niagara Falls. Much of the area has been in commercial fruit production since before the Civil War. As early as 1896 Wayne County, then, as now, the leading tree-fruit-producing county of the area, marketed 5 million bushels of green apples.[1] Today annual fruit production of the area is roughly 10 million bushels of apples, 750 thousand bushels of peaches, 330 thousand bushels of pears, 20 thousand tons of sour cherries, 4 thousand tons of sweet cherries, and 60 thousand tons of grapes.

Fertilizer experiments on fruits in this area were begun about 1890. Hedrick has published the results of a trial conducted from 1900 to 1919 on the Rome Beauty apple.[2] He concluded that some increase in yield and growth might be expected from the use of a complete fertilizer, but that these increases were too irregular and

- Where the people produce 10 million bushels of apples, 750,000 bushels of peaches, 330,000 bushels of pears, 20,000 tons of sour cherries, 4,000 tons of sweet cherries, and 60,000 tons of grapes—in a year.

- Where Cornell leaf analyses indicate *many* apple, pear, and sour cherry orchards and grape vineyards would profit from more potassium fertilization.

- Where Cornell analyses also indicate many apple orchards need treatment for correction of soil acidity and magnesium deficiency.

. . . for apples

too small to show any certain financial benefit. He recognized, however, that each orchard presented a slightly different fertilizer problem and suggested that each grower set up his own fertilizer trial.

Many research workers have been concerned with orchard nutrition in western New York orchards, since that time. Their results all show that nutritional conditions do differ widely from orchard to orchard. Nutritional problems are undoubtedly more prevalent now than at the beginning of the century.

During the summer of 1956 the Pomology Department at Cornell established a leaf analysis service for New York fruit growers to help determine the special nutritional needs of individual orchards. We realized the limitations and the incompleteness of our knowledge on the subject of leaf analysis diagnosis.

At Cornell, leaf analysis has been under active study since the mid-thirties, much of the work being accomplished and directed by Dr. Damon Boynton.

Dr. E. G. Fisher, Extension Pomologist for New York State, is a recognized authority in mineral nutrition. With Dr. Damon Boynton, he has developed the Leaf and Soil Analysis Service for New York fruit growers. He has also served as pomologist for the USDA, working on Tung tree culture in Florida. Additional interests include the use of radioactive isotopes and enzyme relationships in nutrition.

By E. G. Fisher

D. Boynton J. D. Kirkpatrick

•

Cornell University
Department of Pomology

. . . pears

. . . cherries

and grapes

With the backlog of information from our work, and others, *we felt confident in our diagnosis of the McIntosh apple for nitrogen, magnesium, and potassium.* Beyond this, we were not quite so confident. We had little information on what calcium, phosphorus, or certain minor element levels we should suggest. Our information on varietal differences in apple leaf analysis and fertilizer response was meager. As incomplete as our information for adequate diagnosis of the apple was, our facts on other fruits were even less.

Consequently, when we began the service, we frankly said it was on a semi-experimental basis. We limited the service to apples, pears, and sour cherries. We did not feel we had adequate information on peaches and sweet cherries to diagnose these fruits at the present time. Collection procedures were, of course, standardized. For the most part, we limited our sample collection to the month of August and to the middle leaf of the current season's terminal growth. Two samples were collected from a composite of four trees each—trees which were about average for the block. If part of the orchard was considerably better or worse than the average, four trees were composited from these areas.

All trees were tagged so we can return to the same trees and follow leaf analysis and tree performance change with fertilizer application. Soil samples also were collected from tagged trees. All pertinent information concerning the orchard was recorded—soil drainage, crop, past fertilizer history, spray and pruning practices, etc., An accumulation of such leaf and soil analysis and orchard information should enable us to continue improving our orchard diagnostic service.

Orchard Diagnostic Service Results: 1956 Season

The diagnostic service results reported for tree fruits include only those samples collected from *apple orchards.* Soil analysis indicated that apple orchards were generally acid.

Soil pH's of the four major western New York counties are presented in Table I. The figures indicate the number of samples in each county falling within five pH classes.

Sixty-seven per cent of the samples collected were below pH 5.0. Unless dolomitic limestone had recently been applied to these soils, we suggested to the grower that such an application be made to aim for a pH of 6.0.

Leaf and soil analysis indicated *low potassium was a general problem in western New York.* The soil and leaf analysis results for potassium are

Table I. pH of Soil Samples (0–6″ horizon). Orchard Diagnostic Service. 1956

County	<4.5	4.5–4.9	5.0–5.4	5.5–5.9	6.0–+
Wayne	10	22	13	2	9
Monroe	6	11	2	3	0
Orleans	1	3	1	3	1
Niagara	7	10	0	1	0
Total	24	46	16	9	10
Per cent	22.9	43.8	15.2	8.6	9.5

Table II. Potassium analysis results. Orchard Diagnostic Service. 1956
Soil Potassium (lb/acre in 0–6'' horizon) [a]

County	<50	50–99	100–149	150–199	200+
Wayne	18	24	8	5	1
Monroe	3	8	9	1	1
Orleans	5	3	0	0	1
Niagara	1	8	5	1	3
Total	27	43	22	7	6
Per cent	25.6	41	21	6.7	5.7

Leaf Potassium (% d. w.)

County	<.75	.75–.99	1.00–1.24	1.25–1.49	1.50+
Wayne	8	17	20	8	3
Monroe	1	5	5	7	4
Orleans	2	1	1	4	1
Niagara	2	2	7	4	3
Total	13	25	33	23	11
Per cent	12.4	23.8	31.4	21.9	10.5

[a] Analysis procedures used were essentially the quick test procedures of M. Peech and L. English.[3] See Literature Cited.

presented in Table II.

Previous work[5] has suggested soil analysis for potassium for apple trees should be at or above 100 pounds per acre. This is only a rough average figure and will vary with variety, rootstock, soil drainage, soil moisture, soil pH, soil magnesium, soil organic matter, etc.

Deficiency symptoms of potassium rarely occur if the leaves analyze as high as 1.00 per cent of the dry weight. We felt a cushion level might be desirable as an insurance in heavy crop or exceedingly dry years so 1.25 per cent or higher was established as a desirable level for leaf analysis.

Based on these established levels, about 67 per cent of the collected samples showed sufficiently low levels that consideration should be given to potassium fertilization.

Magnesium deficiency was less of a general problem, though leaf and soil analysis indicated it to be a possibility in some orchards. The analysis results are presented in Table III.

Previous work has suggested that the chances for magnesium deficiency are fairly good if the soil analyzes less than 30 pounds per acre of magnesium. This again is only an average figure and will vary with variety, rootstock, crop, soil drainage, soil moisture, soil pH, soil potassium, soil nitrogen, etc. In the absence of unusual conditions, however, magnesium-deficiency symptoms are not likely to occur if the soil analyzes above 60 pounds per acre. Magnesium-deficiency symptoms often occur if the leaves analyze less than .20 per cent but rarely appear if the analysis is .24 per cent or higher. Based

Table III. Magnesium analysis results. Orchard Diagnostic Service. 1956
Soil Magnesium (lb/acre in 0–6″ horizon) [3]

County	<30	30–59	60–89	90–119	120+
Wayne	9	10	7	10	20
Monroe	4	9	1	3	5
Orleans	1	3	0	0	5
Niagara	6	1	4	2	5
Total	20	23	12	15	35
Per cent	19	21.9	11.4	14.3	33.3

Leaf Magnesium (% d. w.)

County	<.16	.16–.19	.20–.23	.24–.27	.28+
Wayne	6	11	12	10	17
Monroe	0	4	0	2	16
Orleans	0	0	2	3	4
Niagara	0	4	2	3	9
Total	6	19	16	18	46
Average	5.7	18.1	15.1	17.1	43.8

upon these levels of 60 pounds per acre in the soil and .24 per cent in the leaves, about 40 per cent of the collected samples showed magnesium levels low enough that consideration should be given to fertilization with this nutrient.

Vineyard Diagnostic Service Results: 1956 Season

The leaf and soil analysis service was extended to *grape growers* in 1956. Much of the background work in the diagnosis of vineyard samples has been done by Dr. Nelson Shaulis of the Geneva Agricultural Experiment Station.[4] Based upon standards which he has established, low potassium might be a problem in about one third of the petiole samples we collected.

The analysis results from Chautauqua County and the Finger Lakes area are shown in Table IV.

Soil potassium was considerably higher in vineyard than in orchard soils. Only about 8 per cent of the vineyard soils were below 100 pounds per acre of potassium; 67 per cent of the apple orchard soils were below the 100 pound level. Despite this about one third of the grape petiole analyses showed a need for additional potassium fertilization. Apparently the grape requires a higher level of soil potassium to maintain adequate leaf levels than do apple trees.

Acid soil conditions and magnesium deficiency were only a minor problem in vineyards.

Three fertilizer plots on Bartlett pears yielded information helpful in diagnosing leaf analyses with this fruit. These were NPK 2 x 2 x 2 factorial experiments begun in the spring of 1954. The plots were set up cooperatively

Table IV. Grape leaf petiole analysis. Vineyard Diagnostic Service. 1956
Soil Potassium (lb/acre in 0–6″ horizon)

	50	50–99	100–149	150–199	200+
Total (52)	0	4	10	8	30
Per cent	0	7.7	19.2	15.4	57.7
Leaf Petiole Potassium (% d. w.)					
	.75	.75–.99	1.00–1.24	1.25–1.49	1.50+
Total (52)	13	8	6	2	23
Per cent	25.0	15.4	11.5	3.8	44.2

with Dr. Kenneth Parker of the Plant Pathology Department at Cornell for the original purpose of studying nutritional effects on fire blight severity. The potassium plots received 5 pounds of muriate of potash and the phosphorus plots 25 pounds of superphosphate per tree at the beginning of the experiment. All trees received an annual over-all nitrogen application which varied between orchards, but all the nitrogen plots received an additional yearly application of 2 pounds of ammonium nitrate per tree.

Potassium applications markedly increased fruit size by 1955 and 1956 if the leaf analysis showed that the treatment increased the leaf potassium content in June from below to above 1.0 per cent. No effect on fruit size was noted if the unfertilized or minus K trees were originally above 1.0 per cent. These data are shown in Table V.

Table V. Fertilizer studies on pear trees [a]

Orchard	Treatment	Leaf Potassium (% d. w.) June, 1955	Weight 25 fruit/ tree, 1955 (pounds)	Weight 32 fruit/ tree, 1956 (pounds)
	+potassium	1.15**	6.5*	12.4**
	−potassium	.68	6.2	11.0
II	+potassium	1.24**		7.5
	−potassium	1.04		7.4

* significant at 5% level.

** significant at 1% level.

[a] These data were collected in cooperation with Dr. Kenneth Parker, Plant Pathology Department, Cornell University.

The additional potassium resulted in larger fruit and fruit which was also greener and less mature at the time of harvest. The number of pear orchards

sampled in the leaf analysis service was too small to establish trends. Fruit size in many orchards would be improved by potassium fertilization, however.

Sour Cherry (Montmorency) Fertilizer Studies

Sixty-four Montmorency sour cherry orchards in western New York have been observed for the past two years. Leaf analysis, soil analysis, and fruit-quality measurements have been obtained. Table VI shows the association

Table VI. Association between soil potassium and leaf potassium in 64 western New York Montmorency cherry orchards.

Number of orchards	20	22	22
Soil potassium, lb/acre 0–6" horizon	52–100	100–225	226–452
Leaf potassium % d. w.	.65–1.00	1.00–1.50	1.50–2.49
July, 1955–September, 1955	.37– .84	.90–1.15	1.15–1.60

between soil and leaf potassium. Levels of 100 pounds or less per acre of potassium in the soil caused undesirably low levels of potassium in the leaves. Apparently sour cherries require a soil level higher than 100 pounds per acre to adequately maintain leaf potassium. Leaf potassium values of 1.00 per cent or greater in August and September were associated with the more thrifty trees. Tree vigor and fruit size were more closely associated with the level of potassium nutrition than with any other variable, including tree age, location, soil type, and cultural practices.

Eleven orchards out of the 64 in the survey had between 60 and 70 pounds per acre of magnesium in the 0-6" horizon. None were lower than 60 pounds per acre of magnesium. All of these trees showed adequate levels of leaf magnesium even at high levels of potassium in the soil. Apparently magnesium deficiency is not a problem with sour cherries in western New York.

Summary

The Cornell leaf analysis service begun in 1956, indicates that many apple, pear, and sour cherry orchards and grape vineyards in western New York would profit from additional potassium fertilization. The results indicated also that many apple orchards need treatment for the correction of soil acidity and magnesium deficiency.

LITERATURE CITED

1. Beach, S. A. The Apples of New York. J. B. Lyon Co., Albany. 1905.
2. Hedrick, U. P. Fertilizing apple orchards. New York Agricultural Experiment Station Circular No. 66. 1923.
3. Peech, M. and L. English. Rapid microchemical soil tests. Soil Science *57:* 167-195. 1944.
4. Shaulis, Nelson and Keith Kimball. The association of nutrient composition of Concord grape petioles with deficiency symptoms, growth and yield. Proc. Amer. Soc. Hort. Sci. *68:* 14-156. 1957.
5. Titus, J. F. and D. Boynton. The relationship between soil analysis and leaf analysis in eighty New York McIntosh apple orchards. Proc. Amer. Soc. Hort. Sci. *61:* 6-26. 1953.

◀◀◀

Growing interest in

PINE TREE FERTILIZATION

By Howard Parker **President**
Sylacauga Fertilizer Company

Interest in fertilizing forest trees is growing. Many folks are asking if it pays to fertilize southern pines. The experiment stations and other researchers are working along these lines. They don't have the whole answer—yet. But fertilization of forest trees, particularly pine trees, looks very promising.

To get an idea of the possibilities, we fertilized a pine tree in the yard of our home at Sylacauga, Alabama, with 2 pounds of 6-8-8 each year for 4 years. The picture (above) tells the story. Both trees were 4½ years old when the picture was taken.

The smaller tree received no fertilizer directly, although it undoubtedly fed some on the fertilizer applied to the taller tree because other trees planted at the same time in the yard are not even as tall as the smaller of the two trees above.

This was not a formal experiment, of course, but it does suggest there are good possibilities in this field.

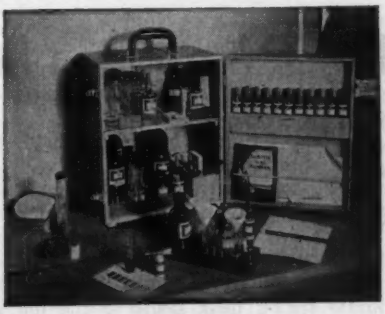
For Reliable Soil Testing Apparatus there is no substitute for LaMOTTE

LaMotte Soil Testing Service is the direct result of 30 years of extensive cooperative research. As a result, all LaMotte methods are approved procedures, field tested and checked for accuracy in actual plant studies. These methods are flexible and are capable of application to all types of soil, with proper interpretation to compensate for any special local soil conditions.

Time-Proven LaMotte Soil Testing Apparatus is available in single units or in combination sets for the following tests:

Ammonia Nitrogen	Iron
Nitrate Nitrogen	pH (acidity and alkalinity)
Nitrite Nitrogen	Manganese
Available Potash	Magnesium
Available Phosphorus	Aluminum
Chlorides	Replaceable Calcium
Sulfates	

Tests for Organic Matter and Nutrient Solutions (hydroculture) furnished only as separate units.



LaMotte Combination Soil Testing Outfit

Standard model for pH, Nitrate, Phosphorus and Potash. Complete with instructions.

Illustrated literature will be sent upon request without obligation.

LaMotte Chemical Products Co.

Dept. BC Chestertown, Md.

In Time & Money

FALL FERTILIZING PAYS OFF

Yield per acre:
80.4 bu.

In these three photos, we see corn that was harvested from plow-sole fertilizer

By C. J. Chapman
Department of Soils
University of Wisconsin

FARMERS who apply part of their fertilizer in the fall unanimously praise this practice—and for good reasons:

1—More time and labor is available to get the job done.

2—Footing for tractors, spreaders, and spreader trucks is usually good and firm.

3—Flow of raw materials from the mines and chemical plants to the fertilizer factory is steady, not only relieving last minute spring peak loads to the manufacturer, but also extending the rail and truck delivery period—which means savings passed on to the farmer.

Prof. C. J. Chapman, Wisconsin native and well-known University of Wisconsin soils specialist, has carried the story of better farming methods to his people for nearly 4 decades. Conducting thousands of fertilizer and lime demonstrations on alfalfa, pasture, small grain, and corn, he has influenced major crop yields.

4—The farmer is assured of getting the kind and amount of plant food he needs.

5—Acute storage problems are lessened for the manufacturer and the dealer.

6—And plant food applied to grass and legume meadows in the fall is there ready to go to work when the spring rains and warm weather "wake up" old fields.

But now, what crops are benefited most? Where, when, and what fertilizers can we apply?

If we can maintain our stands of alfalfa in a high state of production over a period of several years, we save on seed as well as land fitting costs. "Longevity" of stand is a money and labor-saving benefit. *It's a soil conservation practice of the first order.*

Alfalfa is a heavy feeder on potash. and in Wisconsin, as well as in many of the northern states, mixtures rich in this element are recommended. An 0-10-30B (or similar 1-3 ratio of phosphate to potash) is a popular grade for topdressing old alfalfa stands.

True, testing the soil for available phosphorus and available potash will give a better idea of just what ratio of phos-

Yield per acre:

95.5 bu.

Increase per acre:

15.1 bu.

Value of increase:

$90.60

Profit Over Cost of Fertilizer:

$87.98

Yield per acre:

Fall 1943 . . . . 114.8 bu.
Spring 1944 . . 117.7 bu.

Increase per acre:

Fall . . . . . 34.4 bu.
Spring . . . . . 37.3 bu.

Value of Increase:

Fall $206.40
Spring $223.80

Profit over cost of fertilizer

Fall $189.08
Spring $206.48

plots on the Clarence Trachte farm at Johnson Creek, Wisconsin. The results: Hybrid seedcorn. Increase in yield figured at $6 per bushel. High yield per acre: 117.7 bu. Low: 80.4 bu.

phate and potash to use. The soil test levels for available phosphorus and available potassium will likewise serve as a guide for desirable rates of application.

Boron deficiencies have become more and more widespread in recent years. Alfalfa yields and "longevity" of stand may be materially benefited from applications of boron. Boron will frequently increase alfalfa seed production even though there may not have been any foliar evidence of a deficiency of this element.

Mixtures such as 0-9-27B, 0-10-30B, or other combinations to which borax (containing the element, boron) when supplied in sufficient quantities to meet the requirements of alfalfa, have been found profitable on a wide range of soil types in the State of Wisconsin. Testing for available boron is likewise a good way of finding out if a particular field needs this element.

If in short supply, borax can be applied as a direct application at rates of from 20 to 30 pounds per acre. Actually, the cost is negligible and may be looked upon as insurance. Boron deficiencies are more in evidence in seasons of prolonged dry weather.

"Alfalfa Yellows" on the second crop is frequently mistaken for boron deficiency symptoms. Spraying alfalfa fields with a suitable insecticide ten days after the first cutting has been harvested is a positive preventative for "Yellows" due to leaf hopper damage.

Demonstrations Prove Practice Profitable

In order to stimulate greater interest in the topdressing of old alfalfa stands, county agents in some 40 Wisconsin counties set up a total of 302 one-acre demonstrations in 1955, 1956, and 1957. Strips clear across the field were fertilized with 0-10-30B (or similar mixture). In a few cases, the fertilizer was applied the year before, either in the fall or in mid-summer after the first crop had been harvested. Fall application has always given good results and is strongly recommended. Table I shows the average results from the alfalfa topdressing plots. An example of the results from one demonstration is shown in Fig. 2.

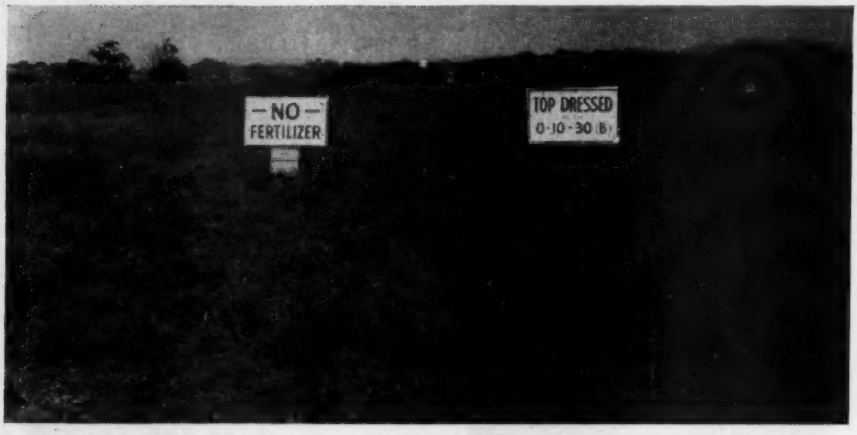


Fig. 2. Alfalfa Topdressed with 0–10–30B @ 450# P/A after First Crop Was Harvested in 1954.

Yields		Topdressed	Not Topdressed
1955	=	6,400 lbs.	4,000 lbs.
1956	=	7,050 lbs.	3,803 lbs.
1957	=	7,087 lbs.	1,237 lbs.
Total Yield		20,537 lbs.	9,047 lbs.
Increase in Yield = 11,497			
Value of Increase @ $25.00 per ton	= $143.71		
Cost of Fertilizer	= 16.32		
Net Profit Per Acre	= $127.39		

(Roy Schlough & Sons Farm, Mazomanie, Wis.)

What about nitrogen for grass pastures, or those old, run-out alfalfa-brome-timothy fields? Yes, Sir! And what wonderful results you will see next year where 10-10-10 * or other high nitrogen fertilizer is applied on such fields!

Topdressing these fields *late in the fall with nitrogen fertilizers* gets results equal to spring application. In fact, in some of our experimental and demonstrational

Table I. Average Yields, Value of Increases and Net Profit Per Acre for all Alfalfa Topdressing Plots Harvested.

Treatment [1]	Yield Per Acre (Lbs.) Dry Matter [2]	Pounds Increase	Value of Increase [3]	Cost of Fertilizer [3]	Net Profit Per Acre
0–10–30B	8,702	2,322	$34.84	$8.16	$26.68
Not Topdressed	6,379				

[1] The 0–10–30B was applied at rates from 450 to 500 lbs. per acre.

[2] Yields are expressed in pounds per acre of dry matter. Representative square yards were clipped from treated and untreated areas, weighed and calculated over to the per acre basis (30% of green weight used as basis for hay yields—second crop in most cases estimated at 1/3 of the first cutting).

[3] The value of the increases in yield figured at $30.00 per ton. Only half of the cost of the fertilizer was charged against the first year increase in yield.

Fig. 3. 500 lbs. of 13-13-13 per acre on this grass pasture increased the dry matter yield 2,437 lbs. A count of the number of heads of grass per square foot in the fenced out area (as of July 13) gave 347 for the fertilized, 66 for the unfertilized.

plots we have shown some advantage for fall application.

Applied at rates from 400 to 600 pounds per acre, 10-10-10 has doubled and even trebled the production of June grass in pastures the following spring. Where applied on old timothy-brome-hay meadows, we have produced an extra ton of high quality hay.

Remember, too, the phosphate and potash in this fertilizer will carry over to the fall period. When the rains revive these pastures or timothy meadows, the growth of native white clover and other species of legumes is frequently stimulated, especially in the old grass pasture meadows. *In fact, these legumes are more in evidence the spring following on pastures that received these balanced fertilizers containing phosphate and potash.*

Comparisons of fall vs. spring applications of the 12-12-12 grade of fertilizer were made on a number of farms in Wisconsin. The results are shown in Table II.

Light Rate Application of Nitrogen Fertilizer on Grassy Sod May Show Little or No Benefit

When there is quite an accumulation of dead grass in a pasture field, the apparent early response to light rate treatment with 10-10-10 or other nitrogen fertilizer may be hardly noticeable, whether applied in fall or spring. The reason is this dead grass is actually food or energy material for the fungi and bacteria responsible for its decomposition. In turn, a high percentage of the nitrogen applied is used up by these microorganisms. But when you apply a rather liberal amount (400 to 600 lbs. per acre) of 10-10-10, rapid decomposition of the dead grass, not only occurs, but the plant food therein is also liberated.

At the same time, enough nitrogen to start the early lush growth of pasture grasses has been supplied. Later on, this nitrogen and other plant food constituents stored in the dead tissues of the fungi and bacteria become available as they decompose and nitrify, thus causing a "delayed action" and a longer lasting benefit to the pasture grasses.

Late Fall Application of Nitrogen Fertilizers on Corn and Hemp (Heavy Silt or Clay Soils) Has Produced Increases in Yield Nearly Equal to Spring Application

Many field scale experiments have shown that late fall-applied nitrogen for fields planted to corn the following year is a practical program to follow. Though there may be some downward movement of nitrates in the fall or spring, this may be an advantage in dry years.

Bob Garst and his sons, David and Stephen, in partnership with Charles W.

Table II. Pasture Topdressing Results, Fall vs. Spring Applications.

Name & Address of Cooperator, and Soil Type	Treatment, and How Applied	Yields in Lbs.—Dry Matter [1]	Pounds Increase	Value of Increase [2]	Cost of Fertilizer [3]	Net Profit Per Acre
Hubert Kelter Black Earth, Wis. Tama Silt Loam	500# 12–12–12 Fall Applied	2787	1947	$48.67	$12.44	$36.23
	500# 12–12–12 Spring Applied	2404	1564	39.10	13.16	25.94
	No Fertilizer	840				
Elmer Goke Belmont, Wis. Tama Silt Loam	500# 12–12–12 Fall Applied	3016	1491	$37.27	$12.44	$24.83
	500# 12–12–12 Spring Applied	3145	1620	40.50	13.16	27.34
	No Fertilizer	1525				
Antone Adler Dane, Wis. Carrington Silt Loam	500# 12–12–12 Fall Applied (1 clipping only)	5100	3225	80.62	12.44	68.18
	500# 12–12–12 Spring Applied (1 clipping only)	5625	3750	93.55	13.16	80.36
	No Fertilizer	1875				
George Koeppel Helensville, Wis., Fox Silt Loam	500# 13–13–13 Fall Applied (1 clipping only)	6300	4800	120.00	12.79	107.21
	500# 13–13–13 Spring Applied (1 clipping only)	6000	4500	112.50	13.50	99.00
	No Fertilizer	1500				
Earl Battist Lake Mills, Wis., Miami Silt Loam	500# 13–13–13 Fall Applied (1 clipping only)	3900	3150	78.75	12.79	65.96
	500# 13–13–13 Spring Applied (1 clipping only)	3000	2250	56.25	13.50	32.75
	No Fertilizer	750				
Average for all Fall Applications		4221	2923	72.07	12.58	59.49
Average for all Spring Applications		4035	2737	68.42	13.29	45.13
Average for No Fertilizer		1298				

[1] In order to secure yield data, farmer cooperators were asked to fence out 6 or 8 square rod areas each of fertilized and unfertilized. Areas of like size were clipped from these plots at 2 or 3 different periods (each time from the same area). Green weight yields were calcu-

lated to the acre basis and 30% of this green weight was recorded as dry matter.

[2] The protein content of nitrogen-treated pasture grasses as grazed by cattle in late May or early June will run from 20 to 22% on the dry matter basis. In fact, the average protein content for nitrogen-treated pasture grasses over the period of May and June and July will run about 18%. With 18% dairy feed costing about $70.00 per ton, we believe that it is fair to figure our increases in yield due to treatment with 12–12–12 at $50.00 per ton.

[3] The cost of fertilizer figured at two-thirds of actual cost since increases in yields recorded here (in several cases one clipping only) do not represent the full benefit from the fertilizer treatment. Fall prices were figured at 10% off the retail list. Spring prices were figured at 5% off list price.

Thomas, of Coon Rapids, Iowa, grow and market annually hybrid seed corn and hybrid grain sorghums from approximately 18,000 acres. On September 13, 1956, I saw hundreds and hundreds of acres of corn making 100 bushels or more per acre in the face of a devastating drought.

Yes, corn had been grown continuously year after year on the same fields over a period of 7 to 10 years. Nitrogen? Yes. Minerals? Yes. *The Garsts broadcast some 200 to 300 pounds per acre of muriate of potash every 2 to 3 years.* They drill in about 200 pounds of 13-39-0 as starter at the time of planting. They spray liquid N-32 on their cornstalks in the fall at the rate of 300 pounds per acre before plowing—or they knife in 200 pounds per acre of N-41 on the fall-plowed fields. And what they don't get done in the fall, they finish doing in the spring before planting their corn. Or, they may sidedress with nitrogen solutions after their corn has been planted, during the latter part of May and early June period.

Afraid of losses of nitrogen by leaching when applied in the fall? No, sir! In fact, they argue that some downward movement into the subsoil of part of the nitrate nitrogen is desirable. They contend that where corn has been grown continuously over a period of several years and where they are certain that some of the nitrate nitrogen had moved down into the subsoil, the corn crop in 1956 stood the drought better than on fields where nitrogen fertilizer was used for the first time. They argue that this downward movement of some of the nitrogen into the subsoil causes deeper rooting of the corn, and that if there is any moisture down there the deep feeding roots are better able to make use of it.

On sandy soils there is some danger of losing part of the nitrogen by leaching before the root system of the crop the following spring has developed extensively enough to pick up this nitrogen. On heavy soils, there is very little danger of losing any of this nitrogen, especially where applications are delayed until mid-October or later (in Wisconsin or states of comparable latitude) or when the temperature of the soil drops to 55 degrees or lower.

Nitrogen applied as a broadcast treatment and plowed under with crop residues such as cornstalks, grain stubble, or weeds will hasten the rotting of this decomposable organic matter and the nitrogen, as previously pointed out, will be pretty largely converted into proteinaceous tissues of the bacteria and fungi which bring about this rotting. Held in this form, the nitrogen is not leachable.

Cold Storage for Anhydrous Ammonia or Low Pressure and No Pressure Nitrogen Solutions

Anhydrous ammonia or the low pressure nitrogen solutions knifed into cool, moist clay loam soils in the northern states stores well and is cheaper storage than the big expensive steel tanks. It can be cut or knifed into grass pastures, hay meadows, or stored in fall-plowed fields which are to be fitted for grain, corn, or other crops the following spring. Your nitrogen is there, ready to feed crops which occupy the land or which will be seeded or planted the following spring.

Bear in mind that storage is one of the greatest problems for the liquid fertilizer manufacturer. He is anxious to keep his plant in continuous operation and will make certain price concessions to those who will take part of his "off-season" output.

"Store it in the soil" are five words that pack dollars into savings for farmers.

A questionnaire the writer sent out to some 30 leading agronomists in the North Central and Northeastern states some three years ago came back almost unani-

Table III. Comparisons of Fall vs. Spring Applications of 8–8–8 and Solution Nitrogen (½ Acre Plots) on Corn and Hemp—1944 and 1956.

Name and Address of Cooperator and Soil Type	Crop	Treatment and How Applied	Yield Per Acre	Increase Per Acre	Value of Increase	Profit Over Cost Fertilizer
Clarence Trachte Johnson Creek, Wis. Miami & Clyde Silt Loam (1944 data)	Hybrid Seed Corn (Planted 3'x3')	250# 2–12–6 in hill	95.5 bu.	15.1 bu.	$ 90.60 [1]	$ 87.98
		250# 2–12–6 in hill plus 700# 8–8–8 on plow-sole (fall of 1943)	114.8 bu.	34.4 bu.	206.40 [1]	189.08
		250# 2–12–6 in hill plus 700# 8–8–8 on plow-sole (spring 1944)	117.7 bu.	37.3 bu.	223.80 [1]	206.48
		No fertilizer	80.4 bu.			
James Farms Ft. Atkinson, Wis. Waukesha Loam (field in high fertility but hurt by dry weather) (1944 data)	Hybrid Seed Corn	125# 2–12–6 in hill	75.7 bu.	2.3 bu.	13.80 [1]	11.60
		125# 2–12–6 in hill plus 700# 8–8–8 on plow-sole (fall of 1943)	77.3 bu.	3.9 bu.	23.40 [1]	6.70
		125# 2–12–6 in hill plus 700# 8–8–8 on plow-sole (spring 1944)	77.2 bu.	3.8 bu.	22.80 [1]	6.10
		No fertilizer	73.4 bu.			
Eric and Ed Aspnes DeForest, Wis. Carrington Silt Loam (1944 data)	Hemp	175# 3–12–12 with drill	3032 lbs.	918 lbs.	13.77 [2]	10.44
		175# 3–12–12 with drill plus 700# 8–8–8 on plow-sole (fall—1943)	7709 lbs.	5594 lbs.	139.85 [2]	
		175# 3–12–12 with drill plus 700# 8–8–8 on plow-sole (spring 1944)	6866 lbs.	4752 lbs.	118.80 [2]	100.77
		175# 3–12–12 with drill plus 250# am. nitrate drilled deep ahead of seeding	7086 lbs.	4972 lbs.	124.30 [2]	114.74
		No fertilizer	2114 lbs.			
	Population (Stalks Per Acre)					
Craig Bean Ft. Atkinson (1956 data)	15,210	300# 0–20–20 plowed under, 200# N–41 knifed in after plowing (fall applied) 250# 5–20–20 starter appl. spring 1956	101.7	26.9	36.31 [3]	16.24
	15,210	300# 0–20–20 plowed under in fall 200# N–41 knifed in spring 250# 5–20–20 starter appl. spring 1956	104.5	29.7	40.10 [3]	20.02
	15,210	200# N–41 knifed in in spring 250# 5–20–20 starter appl. spring 1956	97.3	22.4	30.37 [3]	19.53
	15,470	250# 5–20–20 starter appl. spring 1956	74.8			

[1] Hybrid seed corn figured @ $6.00 per bushel.
[2] Hemp figured @ $30.00 per ton.
[3] Corn figured @ $1.35 per bushel.

mous in favor of late fall application of nitrogen fertilizers.

Many of these men supplied yield data based on carefully conducted experiments which prove without question that nitrogen fertilizer can be applied in the fall with similar results to that applied in the spring *(limited in all cases to the silt and clay loam soils, or when plowed under with crop residues on the sandier soils).*

Yes, there were some minor differences of opinion "for" and "against," but for the most part they said, "Let's get the job done, even though in some cases the results may not be as good as when applied in the spring." Price incentive discounts for fall purchase will, in most cases, more than offset those few cases where spring applications give somewhat larger returns.

In Wisconsin, wet conditions of fields intended for corn prevented the application of "pre plant" anhydrous ammonia and solution nitrogen. In fact, two to three weeks of continuous rain after the corn was planted saturated the fields so much that custom applicator men couldn't get in to apply either anhydrous ammonia or solution nitrogen.

Farmers didn't get all of their ammonium nitrate or urea applied as a side-dressing, either. Crop loss on these fields has cost farmers, distributors and manufacturers hundreds of thousands of dollars.

Some anhydrous ammonia and solution nitrogen distributors in Wisconsin report that they didn't get more than 60% of their contracted acreage covered.

Surely, this situation could have been avoided if part of the nitrogen contracted for by farmers had been applied in the fall of 1956.

I say let's integrate this factor of "seasonal workload" into our program of getting the job done. Let's not take a negative attitude toward "fall application" of nitrogen just because some of this nitrogen may have nitrofied in the late fall or early spring following its application and which by laboratory tests, has been found to move down into the subsoil. . . . It may still be utilized by the deep feeding roots of corn and other deep rooting crops.

"Store it in the soil" is a good slogan, and what the farmer doesn't "store in the soil" he can store in the barn or granary until planting season rolls around next spring.

* 8-8-8, 12-12-12, 13-13-13, or 14-14-14 may be substituted for 10-10-10; or 60.6 lbs. anhydrous ammonia plus 250 lbs. of 0-20-20 will supply the same amounts of N, P_2O_5 as contained in 500 lbs. of 10-10-10.

◀◀◀

YOUR PEACHES DO THEY GET ENOUGH BORON?

Several instances of suspected boron deficiency of peach trees have been observed in the Sandhills area of North Carolina.

The disorder is characterized by reduced leaf size, greatly shortened internodes, excessive branching, reduced fruit set and yield, and occurrence of internal necrosis in the fruit.

The disorder was associated with very low levels of boron as gauged by leaf and twig analysis. Erratic occurrence of the symptoms at a given site has interfered with field experimentation and prevented a more definite diagnosis of the disorder.

More definite diagnosis of this disease will require demonstration of a preventative or corrective action of added boron. Such work can probably best be carried out in the field in spite of the difficulties of erratic occurrence noted above.

It seems probable that a threshold boron level exists in affected orchards and that these symptoms, if they are due to boron deficiency, are brought about by slight changes in boron status possibly related to weather and other environmental conditions.

It would be very difficult to duplicate such a borderline situation in solution culture for a long enough period to produce vegetative symptoms and at the same time to avoid the acute symptoms cited for culture solution studies above. Fruit symptoms would be even more difficult to duplicate. PLANT DISEASE REPORTER.

AGRICULTURE, THE GRE

". . . and ere long the most valuable of all arts will be the art of deriving a comfortable subsistence from the smallest area of soil."

In these words—in a day when farmland was plentiful and 85 per cent of the people lived on the farm to feed the other 15 per cent—Abraham Lincoln came close to summarizing the spirit and mission of agricultural research.

But as he spoke of deriving subsistence from "the smallest area of soil," little did even Mr. Lincoln foresee the day when growing industries, mushrooming suburbs, expanding highways would swallow a million acres of tillable land each year or the day . . .

- **When only 10 per cent of our people would produce the food to feed the other 90 per cent.**
- **When our people would spend $375 million a year on agricultural research.**
- **When a Geiger counter would help research agronomists follow the flow of plant food, containing a radioactive tracer, through growing plants.**
- **When fruit scientists would develop better fruit tree varieties by pollinating the trees by hand.**
- **When corn specialists would cross varieties to produce high-yielding hybrids, resistant to diseases and insects—raising average yields per acre about 30 per cent in just 25 years.**
- **When concentrated orange juice would be frozen and shipped thousands of miles to be drunk weeks later as fresh as it was when it was squeezed.**
- **When plant geneticists would apply a drug to change the nature of plant growth.**
- **When faster feathering and earlier laying hens would build a major poultry industry.**
- **When the humble corncob would be used for everything from a cork substitute to a plastics filler.**

For young men and women interested in seeking new facts, in making something known out of the unknown, in probing plant and animal growth, in finding new markets and better products for all markets, agricultural research offers many opportunities.

According to the National Association of Land Grant Colleges and Universities, hundreds of jobs a year are open for promising young scientists in agricultural research—in *production*, in *market-*

Its Research—A V

No OTHER human occupation opens to w
agreeable combination of labor with cultiva
blade of grass is a study; and to produce tw
a profit and a pleasure. The thought re rs t
can best be combined with agricultural labo
thorough work, and ere long the mos valu
deriving a comfortable subsistence from the

GREAT ADVENTURE—III

ing, in *economics,* in *agricultural engineering,* in *equipment and utilities,* in *processing,* in *new uses and methods,* in *new products,* in *by-products,* in *conservation,* in *reclamation,* in *rural sociology.*

And the shortage of top quality scientists in this nation is "really acute," the National Science Foundation reports. Research programs already planned by state experiment stations and the USDA will need *12,000 more trained agricultural scientists* by 1960. At the end of last year, alone, the U. S. Department of Agriculture had 1,649 vacancies in beginning professional, scientific, and technical positions. And state stations constantly need replacements in their 3,400 full-time research positions. The feed industry, alone, employs an estimated 1,100 research scientists and laboratory technicians.

In 4 decades—just 40 years—our agricultural output has grown 75 per cent on the same acreage and with *2,500,000 fewer* farm workers. The total output per man engaged in farming has increased 140 per cent.

Agricultural research is an exciting, rewarding story . . .

- **A story of fast changing chemical companies that produce new fertilizers and new sprays and powders to kill insects and weeds.**
- **A story of important petroleum companies continuously studying the fuel and lubricant needs of farm machinery.**
- **A story of drug and chemical firms competing vigorously with each other to produce new and better antibiotics.**
- **A story of USDA and state experiment station laboratories breeding better, more productive crop varieties, healthier, more valuable livestock—and seeking adequate markets for them.**

Agricultural research is an exciting, rewarding career for young men and women inclined to wonder and intelligent enough to search for the answers to their wonderment. Such youth are needed—those trained in the natural, social, biological sciences. They need not be farm born or reared. According to M. T. Harrington, president of the American Association of Land Grant Colleges and Universities, "Agricultural colleges today enroll thousands of young men and women from the cities . . . interest and aptitude count more toward success in an agricultural career than background."

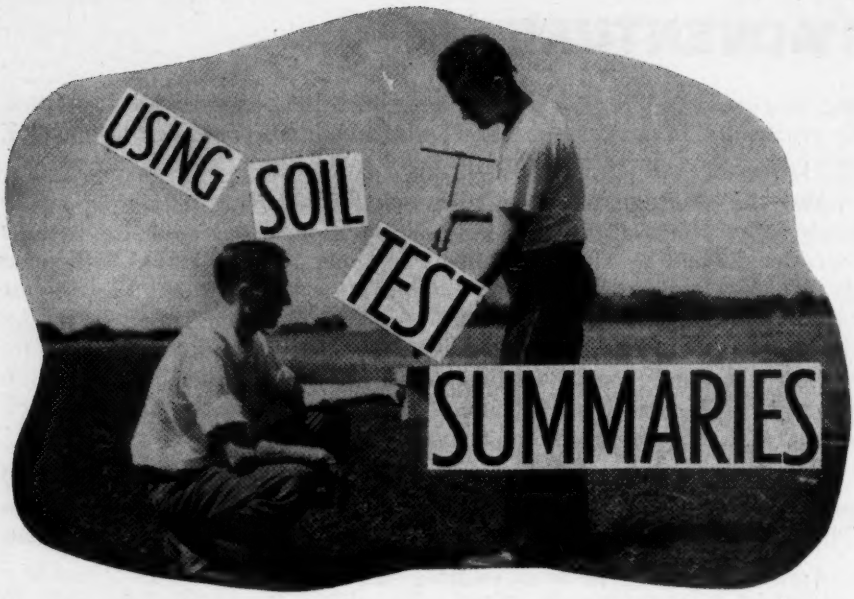
Call him what you may—agronomist, cytologist, geneticist, animal breeder, pedologist, entomologist, pathologist, animal biochemist—the agricultural research scientist is one of the world's important citizens.

—A Valuable Art

ens o wide a field for the profitable and
a c tivated thought as agriculture. Every
odu e two where there was but one is both
re rs that education—cultivated thought—
ral labor; or any labor, on the principle of
nos valuable of all arts will be the art of
on the smallest area of soil.

Abraham Lincoln

By W. F. Bennett and J. J. Hanway



Iowa State College Soil Testing Program

SOIL test summaries are being prepared in many states where an adequate number of soil samples have been tested to provide meaningful data. These summaries can provide useful information for several groups within the state:

• In Extension, they can be used extensively in the agronomic phases of the county educational program, as well as for resource material in planning the county program.

• For research workers, they can serve as guides for directing phases of the fertility research work.

• In the college and high school classrooms, they can be used as teaching aides.

• Commercial groups can also use these summaries in determining general fertility needs in various areas of the state.

Dr. John Hanway, Nebraska native, is Associate Professor of Agronomy and head of the Soil Test Lab at Iowa State College. He earned his B.S. & M.S. from Nebraska, his Ph.D. from Iowa State. Specialist in plant analysis, he is chairman of a regional soil test committee and member of a plant composition committee under the National Research Council.

In Iowa these summaries are based on the results of over a third of a million soil samples tested in the Iowa State College Soil Testing Laboratory since 1948. This large number of samples provides an adequate basis for characterizing the general fertility levels of different areas in the State. The following is a discussion of the kinds of summaries, methods of presenting the data, and the way in which this information has been used in Iowa.

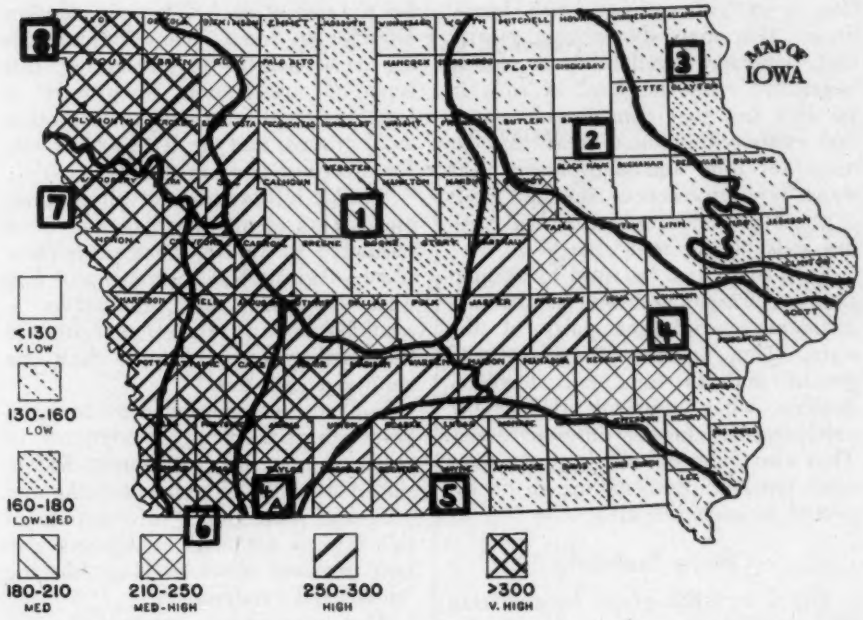


Fig. 1. Distribution of Available Potassium in Iowa Soils by Counties. Numbered areas represent soil-association areas.

Kinds of Summaries

(1) Summaries of lime, nitrogen, phosphorus, and potassium test results for each county and soil association area of the state.

(2) Summaries of lime, nitrogen phosphorus, and potassium test results for different types of soil within each county.

(3) Number of samples per farm and number of farms sampled in each county.

(4) Number of acres represented by each sample.

When the results of the different soil tests are summarized for an area, they show the fertility variations of the soils in that area and indicate which nutrients are most deficient. Summaries are usually prepared on a county basis. However, where several counties have similar soils, the results for all these counties may be combined to give an area or regional summary. And, where adequate data is available, summaries may be prepared for different types of soils within each county or area.

State Summary

Variations in soils from different parts of a state may be illustrated by maps, such as that shown in Fig. 1. This map shows the average

William F. Bennett, Oklahoma native, heads the Extension phases of the soil testing program at Iowa State College. Before doing this, he earned his B.S. at Oklahoma State, his M.S. at Iowa State, and supervised the Eastern Branch Soil Testing Laboratory at Cedar Rapids.

potassium test for all samples from each county. Different soil association areas are outlined with heavy lines. This map shows very clearly that potassium availability is closely associated with the kind of soils in an area but that considerable variation exists within some areas. Similar maps for lime and phosphorus tests show how differences in the levels of these nutrients are associated with the soils of different areas.

Such maps can be used to emphasize the nutrient deficiencies that are common in different parts of the state. They indicate to educational groups and to lime and fertilizer dealers what nutrient deficiencies need emphasizing in different areas. They also show soil fertility specialists what nutrient problems are to be expected in each soil area.

County Summary

Fig. 2 is a bar graph summarizing the nitrogen test results for Taylor County, Iowa. It shows what per cent of soils in the county test very low, low, medium, or high in nitrogen availability—a relatively simple way to show the variations in fertility levels within an area. *A set of slides summarizing the lime, nitrogen, phosphorus, and potassium tests in this way for each county and soil association area has been prepared for the use of each County Extension Director in Iowa.* These visual aids are very helpful in presenting this type of information to groups of farmers, fertilizer dealers, and other local groups, and are used extensively for meetings of such groups.

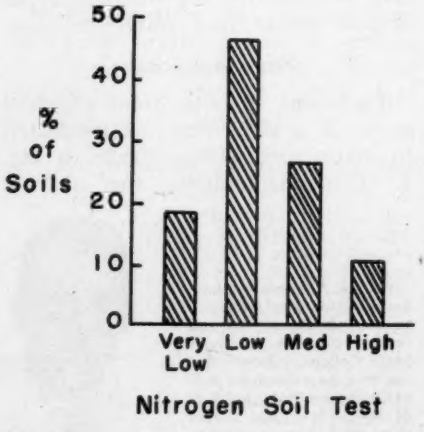


Fig. 2. Nitrogen Soil Test Summary for Taylor County, Iowa.

Similar information for all counties and soil association areas has been tabulated in an Iowa extension pamphlet—Agron. 360 "Summary of Soil Test Results." The information is available to any group interested in the fertility status of more than one county or soil area.

Soil test summaries provide valuable information as background or resource material for County Extension workers in program planning and program projection. Information of this type is essential in defining certain problem areas and establishing "situational" statements.

The summaries mentioned previously showing distribution of lime needs, nitrogen, phosphorus, and potassium within a county can be used to define basic fertility problems within a county. Together with information on present cropping systems, general fertility needs can be established and compared with present use.

Soil Association Summary

Information of this type may also be illustrated as shown in Fig. 3 by using circular or "pie" diagrams. These diagrams for each soil association area in Iowa have been published in Pamphlet 228, "Guide to Fertilizer Use." This pamphlet gives general fertilizer suggestions for each soil association in the state. The soil test summary shows the most common fertility level of the soils in the area. This is the fertility level upon which the general fertilizer suggestions are based. But, the summary also emphasizes that different soils in the area test differently so a farmer

Carrington-Clyde Soil Association Area

Area Soil Test Summary

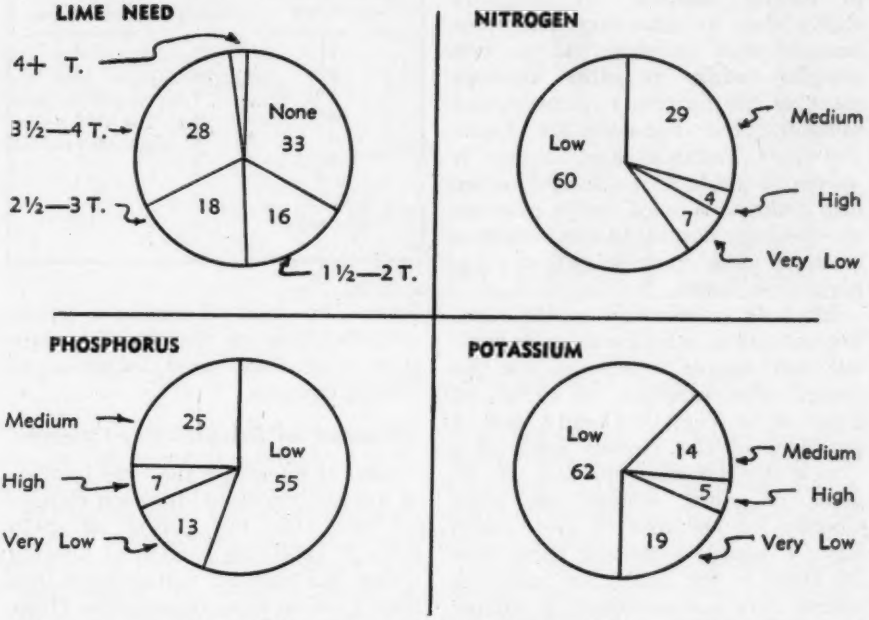


Fig. 3. Summary of Soil Test Results for the Carrington-Clyde Soil Association Area (Area 2) as Used in "Guide to Fertilizer Use," Iowa State Pamphlet 228.

should have his soil tested to determine the lime and fertilizer needs for his specific field.

For certain purposes, it is desirable to show more detailed information about the fertility levels in an area than just the percentages of the soils that fall in different soil test classes. Each soil test class, such as low, medium, etc., includes a range of soil test values. Fig. 4 shows a frequency distribution of phosphorus soil test values for Soil Association Area 5 in southern Iowa (see Fig. 1). It is apparent many of the soils in the low class—3 to 7 pounds of phosphorus per acre—fall in the low part of this class with a test of 3 to 4 pounds per acre. Such information serves research workers and others interested in more information than found in a summary by soil test classes only.

Summary By Soil Type

In addition to this, summaries showing how different soils differ in their level of fertility can be made. Fig. 5, showing the summary of phosphorus tests for various slope and position categories for soils in Page County, Iowa, shows how different soil types will vary in their available phosphorus status. Such a summary indicates the fertility status of various soil types within a county and allows the County Extension Director to emphasize certain problems peculiar to each soil area in the county.

Other valuable types of soil test summaries show such things as the

number of samples submitted and acres represented by each sample. For example, how many samples do farmers have tested? Do they send in one sample or do they sample several fields on their farm and send in several samples? A summary shows that in some counties most farmers send in only one or two samples, while in other counties many of the farmers send in several samples. The summary for Lucas and East Pottawattamie County is shown in Table 1. Such information may indicate a need for a program to encourage farmers in some counties to do a more complete job of sampling their farms.

Table 1. A Summary of the Number of Samples Submitted for Testing by Farmers in two Iowa Counties

Number Samples Submitted	Per cent of Farmers Submitting Samples	
	Lucas County	East Pottawattamie
1	55	8
2	26	12
3	9	12
4	4	17
5	2	7
6	2	7
7 to 9	1	15
10 to 12	0	12
13 or more	0	10

Similarly, a summary of the number of acres in a field that an individual soil sample represents can be useful. For example, as shown in Table 2, in Wapello County, only 1 per cent of the farmers send in a sample to represent an area of 20 acres or more, whereas in Lyon County, 49 per cent of the farmers have 1 sample represent more than 20 acres in the field. Soil sampling instructions recommended a sample be collected for *each 10 acres* in the field. This kind of summary shows another phase of the sampling program that may need emphasis in certain counties.

Number of Samples Per County

Also of interest is the total number of soil samples tested for each county. In Iowa for the period of 1948 through 1956, the number of samples tested per county varied from less than 1,000 to more than 9,000. However, since the counties vary in size

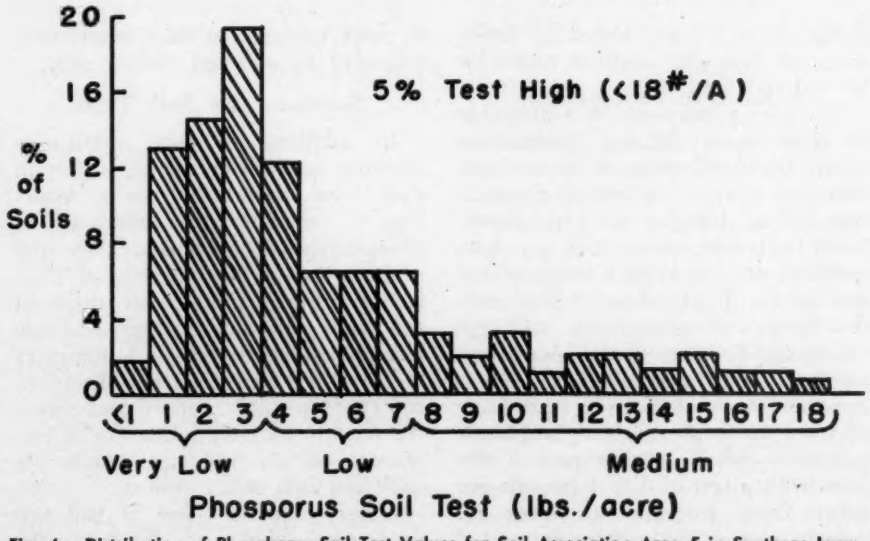


Fig. 4. Distribution of Phosphorus Soil Test Values for Soil Association Area 5 in Southern Iowa.

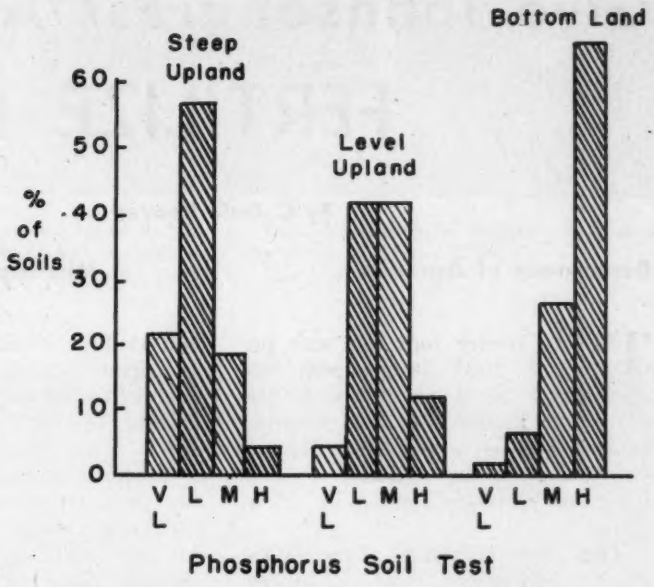


Fig. 5. Phosphorus Soil Test Summary Based on Slope and Position of Soil in Page County, Iowa.

this does not give a reliable value to use in comparing the sampling programs in the different counties.

A relative value for comparing the extent of sampling in different counties may be obtained by dividing the total number of samples from a county by the number of farms or by the number of acres in the county. Such calculations show the number of samples received from 1948 through 1956 varied from an average of 0.5 to 4.2 samples per farm in different counties and that for each soil sample tested from a county, the acres of farmland varied from 35 to 350 acres in different counties. This indicates much more extensive sampling in some counties than in others. These summaries also indicate the extent of sampling in a county depends on how much local interest there was in soil testing and upon the type of a soil sampling program that was conducted in the county.

Many local groups in a county often promote soil testing as a means of extending fertility education and efficient use of fertilizers. Such activities are often cooperative ventures involving several groups. Information such as that above concerning the soil sampling being done in individual counties may serve as useful guides toward improving these local programs.

Much of this information is available to the county extension agent and others in the county, but few such workers have or are willing to take the time needed to assemble it in a usable form. However, when made available by the college agronomists, it is used extensively in each county. By doing the work for all counties at a central location, the data can be assembled with less effort than if it were to be done in each county individually.

Table 2. Summary of the Number of Acres in the Field Represented by Each Soil Sample from two Iowa Counties

Acres Represented by Each Sample	Per cent of the Samples	
	Wapello County	Lyon County
0–10	87	25
10–20	12	37
20–40	1	26
more than 40	0	13

Give Johnsongrass A Break . . . FERTILIZE IT

By C. Dale Hoover

Department of Agronomy **Mississippi State College**

TEN to twelve tons per acre per year of good Johnsongrass hay appears to be a possibility in the Black Belt Prairie Belt of Mississippi, according to the report of Dr. Thomas C. Tucker in the October (1956) issue of "Better Crops With Plant Food."

This demonstration near West Point, Mississippi was continued through 1956 to determine full season production of Johnsongrass in this soil area, and the results briefly reported. To avoid repetition, the general information about the Black Belt soil area is not repeated herein.

The striking response of Johnsongrass meadow to the application of a complete fertilizer on the farm of S. P. Lenoir is illustrated in Fig. 1. This same type of response can be seen in Fig. 2 which shows a half-acre demonstration on the same farm adjacent to the fertilizer test.

Total hay yields for the season varied from *1501 pounds per acre for no fertilizer* to *25,300 pounds per acre for a complete fertilizer* (Table I). These yields strikingly indicate the need for all three elements—nitrogen, phosphorus, and potassium. Nitrogen, alone, gave a yield of 4078 pounds; nitrogen and phosphorus, 8803 pounds; nitrogen and potassium, 8678 pounds; and, *when all three were added* as indicated above, the yield was *25,300 pounds dry hay per acre.*

On the basis of the composition of Johnsongrass hay as reported by Tucker in the October (1956) issue of "Better Crops With Plant Food,"

Table I. Yields of Johnsongrass Hay as Affected by Fertilizer Treatments on a Black Prairie Soil Near West Point, Mississippi (farm of S. P. Lenoir, 1956)

Treatment in lbs./A.			Cutting in pounds green wt./A				Dry Hay lbs./A
N	P_2O_5	K_2O	First	Second	Third	Total	
0	0	0	1936	1815	605	4356	1501
400	0	0	5445	3025	1210	9680	4078
400	400	0	10769	10890	2420	24079	8803
400	0	400	8591	9075	3327	20993	8678
400	400	400	21296	33880	6050	61226	25300

Dr. C. Dale Hoover, a Kansas native, is head of the Agronomy Department at Mississippi State College. He earned his B.A. and M.S. from Kansas State Teachers College, his Ph.D. from Iowa State College in soil fertility and soil chemistry. Among his publications are several on potassium fixation and release.

Figure 1. NPK (400 lbs./A. each of N, P_2O_5, and K_2O). Treatment vs no fertilizer. A Johnsongrass meadow in the Black Belt Soil area near West Point, Mississippi. 1956.

Figure 2. Fertilized left (NPK) No fertilizer right

This is the original half acre demonstration on the S. P. Lenoir farm near West Point, Mississippi. It was started in the spring of 1955. No record of yield was kept in 1955, but with the plentiful moisture and three good cuttings of hay, the yield is estimated at 75,000 to 80,000 pounds of green material. 1956.

Figure 3. Johnsongrass meadow on farm of S. P. Lenoir near West Point, Mississippi. Border between NP and NK plots has tall Johnsongrass. By means of the rhizomes, the plants were able to get a complete fertilizer—P from the NP plot and K from the NK plot. N, P and K were applied at rates of 400 lbs. N, P_2O_5 and K_2O per acre. 1956.

(N = 1.54%; P = 0.33%; K = 2.07%) 25,300 pounds of dry hay would contain 390 pounds N, 191 pounds of P_2O_5 (phosphate), and 631 pounds of K_2O (potash). Such high rates of plant food removal in harvested hay would require annual or semi-annual additions of a complete fertilizer at a high rate with a possible need for small quantities of minor elements.

Complete fertilizer also had a decidedly beneficial effect on the quality of the hay. Estimates of the percentage of Johnsongrass making up the hay were made at the date of the first cutting, as shown in Table II.

Table II. Estimated Percentage of Johnsongrass in the First Clipping (Lenoir farm May 24, 1956).

Treatment*	Per cent	
	Johnsongrass	Other
N	50	50 weeds
NK	75	25 weeds
NP	2	98 Cheat
NPK	99	1 weeds

* Rates same as shown in Table I.

The stand of Johnsongrass was maintained by a complete fertilizer, whereas the stand deteriorated when phosphorus or potassium was omitted.

It is interesting to note in Fig. 3 how effectively the borders between the NP and NK plots showed the effects of a complete NPK fertilization the second year as a result of the rhizomes utilizing P from the adjoining NP plot and K from the adjoining NK plot.

From Figs. 1, 2, and 3, as well as the yield data in Table I, it is quite evident the Black Belt soils of Mississippi provide a heretofore unrecognized potential for producing good Johnsongrass hay.

Precise experiments are needed before general recommendations can be made, but these data certainly point to some interesting possibilities of much more forage production on Black Belt soils.

In this soil area—consisting of approximately 1.4 million acres in which Johnsongrass seems to be so well adapted—the potentialities for increased forage production may be greater than anywhere else in the South. ◄◄◄

MORE HIGH-ANALYSIS NEEDED

FLORIDA AGRICULTURIST SAYS

Florida farmers don't need a good, five-cent cigar nearly as badly as they need to use more high-analysis fertilizers—says the University of Florida Agricultural News Service.

Although Florida is second in the nation in amount of plant food used, it has fallen behind in the adoption of fertilizers with more plant nutrients per sack, according to Dr. H. L. Breland of the Florida Agricultural Experiment Station.

Groves, grain fields, pasture, and truck land are receiving an average of three-fourths ton of fertilizer per acre. That totals up to 1¼ million tons.

The analysis of fertilizer refers to the percentage of nitrogen, phosphoric acid, and potash, the basic plant foods. The rest of the fertilizer is filler. A 6-6-6 fertilizer is considered low analysis; 12-12-12 is high analysis.

Dr. Breland says high analysis fertilizer will give the grower more total plant food at a saving.

The Editors Talk

OF COUSINS AMAZED

To many American consumers concerned far more with grocery prices than parity prices, the farmer is still the one-gallowsed plowman with a straw in his teeth sitting out a Saturday afternoon down at the Podunk Store.

These city cousins, who have done much to perfect mass production and quality control, would be amazed if they really knew what it takes to mass produce and control quality outdoors—in the face of hailstorms, rains, winds, droughts, 100-degree temperatures, and all the other hazards weather throws at the farmer.

In their factories and business houses, the temperature is controlled, disease doesn't exist, the routine is pretty well set. But have they ever scheduled a corn seed to burst out of the earth the morning *after* the last spring frost?

Down their assembly lines skilled mechanics keep the bugs out, and the finished product always comes out in the end ready to sell, sharp as a tack—or they know the reason why. But have they ever walked down a corn row burned by drought or infested with borer or stunted by leaf blight?

Meeting production deadlines is achieved through efficient management and teamwork—and planning, budgeting, scheduling their costs and profits so the profits will mean something at the end of the year. But have they ever met a 90-day maturity deadline for a sensitive vegetable crop or rushed to put in irrigation, to save an expensive crop, only to have soaking rains come the morning after?

They feed their machinery a certain fuel and it runs and produces and serves them well—over and over and over. But have they ever fed plant food to a soil only to have the crop unable to use it due to faulty application machinery, too much or too little rain?

Their production is usually very systematic, the same bolt turned the same distance, the same package sealed the same way—by the hundreds, by the thousands. But have they ever worked one day repairing a tractor transmission, another building a new fence, another operating a corn harvester, another auditing financial records, another taking soil samples for testing their land?

If they have, then they know farming today is the most complex business in the world—and the farmer a remarkable businessman.

RESEARCH

GIVES NEW WORTH TO LONG NEGLECTED CROP

By Director John H. Longwell **Agricultural Experiment Station**

Amazing improvement of farm crops by experiment station research in the last 50 years may well rank as one of the seven wonders of the modern world. This fact is stressed by the "Soybean Story" in the introductory pages of the annual report of the University of Missouri Agricultural Experiment Station, Bulletin 676.

Grown for centuries in its primitive form by the Chinese and their neighbors, the soybean was long neglected in Europe and America. Introduced into Germany in 1712, it was there viewed only as a botanical specimen. The earliest shipment of these small beans to America in 1804 aroused local interest in Pennsylvania and was endorsed by at least one farm writer as "adaptable and worthy of cultivation."

So limited was this early interest, however, that another century passed before the exotic bean received serious study in this country—on a national scale. Such work was begun by the Land-Grant College experiment stations, just 50 years ago.

This movement was the outgrowth of a study undertaken by Dr. C. R. Ball in the U. S. Department of Agriculture in 1907—with the 23 strains and varieties of soybeans then known. By 1910 Missouri and other corn belt states were sharing in these investigations.

By the latter date the Missouri Station had set up research projects on both soybeans and cowpeas. In the annual report of this station for the year 1913-1914 appears the following statement: "About 70 varieties of cowpeas and soybeans are being tested. Some are superior as hay producers while others are much better for seed." The most promising varieties of each type of soybeans—hay and grain—were being tested also throughout the state in cooperative experiments with farmers.

Under date of January 17, 1927, the College of Agriculture issued a publication entitled, "What the College of Agriculture Is Doing for Missouri," in which the following statement appeared over the signature of F. B. Mumford, Dean and Director.

"In ten years the College of Agriculture has helped transform an unknown plant into a $15,000,000 annual crop for this state. Ten years ago the College was the chief grower of soybeans in Missouri—growing hundreds of strains and varieties to test their adaptation to Missouri conditions. Now Missouri farmers are annually growing 350,000 acres of soybeans for seed and forage, besides 500,000 acres in combination with corn for hogging down and for silage."

In two decades American agricultural research had developed a new major cash crop providing unique advantages in land-use planning, livestock feeding, and industry. But great as these gains seemed 30 years ago, they were to be increased five-

THE SOYBEAN

University of Missouri

fold by additional research from that time to the present.

The soybean plant, unchanged by many centuries of traditional culture in the Orient and even neglected for two centuries after its introduction to the West, has at long last—within our own time—yielded vast and versatile treasures for a hundred modern uses.

Today's soybean is far different from the earliest importations, which were short and squatty with pods less than an inch in length and bearing but one or two very small dull-black seeds. Today's plants, waist high with 2½-inch well filled pods, produce richly colored beans packed with protein and oil—up to 40 per cent protein and 20 per cent oil.

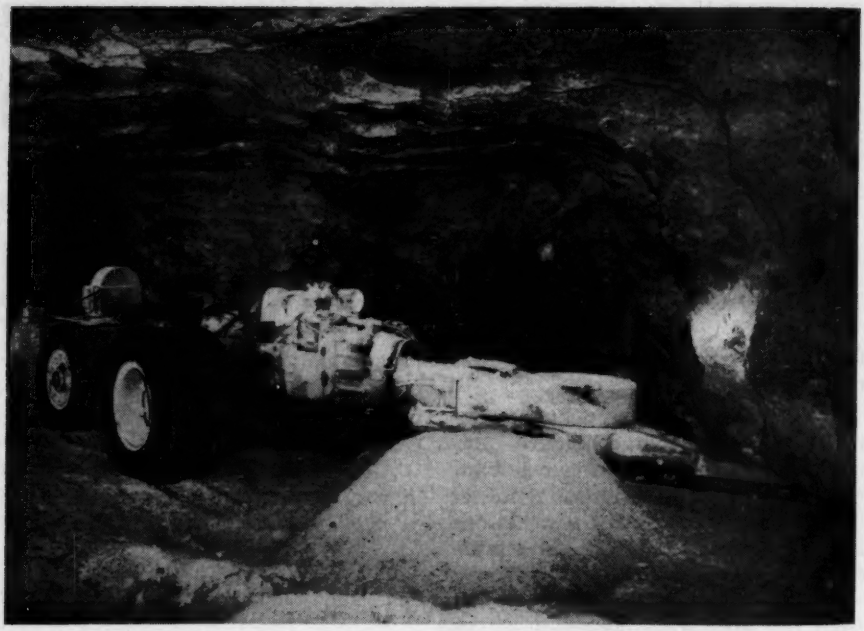
For Missouri the soybean now has an annual cash value of $75,000,000, five times that of the state's 1926 crop. Today, Missouri farmers plant about 2,000,000 acres of soybeans each year. They harvest 97 per cent of that acreage for grain and the remainder, some 50,000 acres, for hay or silage. The acre yield also has been almost doubled in the last 30 years—from 11.7 to 20.1 bushels.

In addition to its special values in protein and oil, the soybean offers strategic advantage as a crop that can be grown on "adjustment acres"; that is, land taken out of corn, wheat, cotton or tobacco acreage in surplus control programs. As a matter of fact, the increase of Missouri's soybean acreage since the end of World War II, amounting to 1,250,000 acres, was more than equal to the required reductions in acreage of the "distress" crops just mentioned.

Improved soybeans came in time also to help farmers meet a much earlier emergency—the soil's lime deficiency, which starved out Missouri's red clover stands after the close of World War I. Much of this annual loss of high protein forage was replaced by new crops of hay-type soybeans. By 1930 approximately two-thirds of the state's 448,000 acres of soybeans were used for hay, and one-third for grain.

But this trend was reversed by the wartime economy of the early 1940s, calling for high-oil soybean strains and industrial facilities to extract the oil and process the meal for livestock feed. Raw soybean protein is not fully digested by farm animals, but this difficulty is removed by heating. Thus treated in the manufacturing process, soybean protein has feeding value equivalent to that of animal proteins, as in meat, milk or eggs. This, too, is a recent advance in agricultural knowledge.

So many new values have been added to the soybean in this all-round transformation of the crop and its utilization, that it is now grown in this country on almost 20,000,000 acres annually. A rich, perennial harvest from 50 years of agricultural research!



Joy 15RU Undercutter at work, undercutting underground face prior to drilling and blasting in a major potash mine in Southwest United States.

SALTS OF THE EARTH

BY ERWIN J. BENNE

MICHIGAN STATE UNIVERSITY

THERE is an old fable that tells why sea water is salty and steadily grows more so.

According to legend, the salt supply of some sailors at sea ran out. Their food was so flat and tasteless without salt they appealed to their gods to send them some and in response to their prayers a gnome appeared on the deck with a queer looking machine in his hand. He told the captain that when salt was desired it was only necessary to say certain words and the machine would grind some out. Then he disappeared, leaving the machine behind.

Overjoyed, the captain called the crew about him, repeated the magic words, and just as had been promised, the machine began to turn out salt. It ground steadily on, until soon plenty of salt was produced, making everyone very happy. When the captain sought to stop the machine, he realized he had neglected to ask how to do so. Nothing he could do or say would stop it. Soon the weight of accumulated salt was about to sink the ship, so he commanded the sailors to throw the machine overboard. And ever since, according to the story, it has been grinding out salt, making the sea more and more salty.

As in many myths, there is a real basis for this story. Sea and ocean water is becoming more and more

Bonneville Salt Flats 125 miles west of Salt Lake City, Utah. (Courtesy of the Chamber of Commerce of Salt Lake City, Utah.)

salty as time goes on. Of course, there is no machine at the bottom of such basins grinding out salt, but there are certain forces constantly removing salts from the land and carrying them to the oceans, making the land poorer and the oceans richer in salts.

Common table salt, of course, is but one of a great number of such compounds. Chemically, salt comes from a metal combining with an acid, and since there are more than sixty metals and a great many acids in existence, a very large number of salt combinations are possible. Indeed, salts are scattered everywhere.

Soils contain salts, plants contain salts, our bones and teeth are made up of salts, and salts perform important functions in our blood. Some rocks are composed of salts, and large deposits of salts occur in many places —not only in our own country, but all over the world.

Limestone and gypsum beds, the great phosphate accumulations of the United States and Africa, the aggregations of potash in western and southwestern United States and of borax in California, the famous nitrate beds of Chile, and the Stassfurt deposits of Germany are as truly salts in the chemical sense as are the deposits of common salt in Michigan, Kansas, and

Graduate of Kansas State, Dr. Benne taught in the Chemistry Department there for 8 years. For 20 years, he has served on the research staff of the Michigan State University Department of Agricultural Chemistry. He has authored or coauthored nearly 60 scientific publications. Among his many memberships are positions in the American Chemical Society and the American Society of Agronomy.

Mining phosphates in Florida. The dragline is equipped with a 25-cubic yard bucket. (Courtesy of the International Minerals and Chemical Corporation, Chicago, Illinois.)

Utah.

The chemical name for ordinary table salt is sodium chloride, because it is a combination of sodium metal and hydrochloric acid.

Gypsum is calcium sulphate, formed by the union of calcium metal and sulphuric acid.

Limestone is chiefly calcium carbonate formed from calcium and carbonic acid.

Chile saltpeter, the material found in Chile and used so extensively for nitrogen fertilizers, is a salt of sodium and nitric acid called sodium nitrate.

The phosphate deposits, the source of most phosphate fertilizers of commerce, are calcium phosphates, compounds of calcium and phosphoric acid. Calcium phosphate is the chief constitutent of bones and teeth, and skeletons of prehistoric animals have added to some of the phosphate beds.

Potash accumulations contain the chloride and sulphate of potassium, and borax is the salt of sodium and tetraboric acid.

Clay contains aluminum, iron, and potassium silicates, salts of these metals and silicic acids that occur abundantly in soils. Silicates of these and other metals constitute an important part of the crust of the earth.

Thus, the list of salts could be extended almost indefinitely; in fact, the majority of useful minerals and ores are salts of one kind or another.

As mentioned in the beginning, oceans, inland seas, and large lakes without outlets, like Great Salt Lake in Utah, contain enormous amounts of various kinds of salts, not only dissolved in the water but as crusts on the shores and in layers which have settled out on their bottoms.

Many of these salts have been car-

Between the coastal mountain range and the lower slopes of the Andes lies the Nitrate Desert of northern Chile. Here in an area approximately 450 miles long and 50 miles wide in one of the most barren spots on earth are found the only commercial deposits of sodium nitrate in the world. (Courtesy of the Chilean Nitrate Educational Bureau, Inc., New York, N. Y.)

ried in from the land. As water percolates through the soil, some of the salts there dissolve and are carried along in solution. Those which dissolve most freely are carried away most rapidly; however, over long periods of time even the most resistant forms yield appreciably to the solvent action of water.

Water from the land always moves toward an ocean or sea. It may travel a very indirect course, often halted or turned aside temporarily. It may wander about over a plain, stagnate as a marsh or broaden out into a lake, but, except in cases where it is dried up among the desert sands, it at last pours into some great water basin with its load of dissolved salts.

This may be an inland sea or a lake without an outlet—but is most commonly an ocean. The energy of the sun, however, continuously removes water from these basins by evaporation, leaving the salts behind. This water rises into the air as vapor, eventually condensing and falling as rain. By this process, water is transferred from ocean to land, from valley to hill. But as the rain water falls upon the land, it acquires a new load of salts on its wanderings toward an ocean. This cycle is repeated over and over today—just as it has gone on for ages past.

These processes not only remove the scattered salts of the soil but also great portions of solid rocks composed of salts—carrying them all to the sea. The caves and caverns in limestone regions were formed in this way. Acids dissolved in the water caused the calcium carbonate to be removed from the limestone—which produced a crevice, which eventually magnified into a cavern. The Mammoth Cave of Kentucky and Carlsbad Caverns in New Mexico resulted from such forces working through endless ages of time.

Sometimes soil areas suddenly sink down in a mysterious manner, leaving an open hole above. Such sink holes develop when salts from the rocks below are removed by the leaching

action of water and the weight above finally crushes the remaining support, plummeting the soil into the space below.

These are but spectacular manifestations of processes operating continuously to decrease the salts of the land and to enrich those of the oceans.

When the water in an ocean or a sea can no longer hold in solution all the salts present, some of them settle to the bottom of the basin to form layers of sedimentary rocks. In this way, limestone, gypsum, common salt beds of the world, potash accumulations, and many phosphate deposits, have been formed.

Usually the salt which is least soluble settles out first, leaving the more soluble salts in solution. Aquatic plants and animals withdraw certain of the salts from solution but find little use for others. Later when these organisms die and decompose, the insoluble salts within them precipitate and add to the layers on the bottom. If conditions change so water in these basins evaporates faster than it is replenished by the rivers emptying into them, they slowly die and disappear, and finally all of the salts are deposited.

These principles are illustrated by a succession of past events that occurred in what is now the central and southwestern areas of North America. At one time in the geologic past, this region was inundated by a sea. Salts accumulated in the sea for ages, but as the water supply decreased they began to precipitate out. Calcium carbonate settled to the bottom to form the limestone strata so common to the region. Calcium sulphate left solution to form the layers of gypsum now used extensively in the manufacture of cement. Sodium chloride and salts of potassium, of magnesium, and of other metals precipitated out when their solubilities were exceeded as the sea receded to the deeper parts of the basin. Similar processes produced the famous deposits of potassium salts at Stassfurt, Germany and in New Mexico.

As soon as the bottom of a basin is exposed, however, the old, familiar forces of weathering and leaching start operating, carrying the salts left there away to a new ocean. Where rainfall is heavy, leaching is more rapid and the salts are removed more quickly than where rainfall is light. Thus, the soils of arid regions are still rich in soluble salts; whereas, those subjected to a very wet climate contain little or no soluble salts. Many of these salts are necessary to supply mineral nutrients to plants, and when the supply of them in cultivated soils becomes insufficient, more must be added as fertilizers.

Too high a concentration of soluble salts, however, is toxic to many plants. This condition exists in some desert soils, and before salt-sensitive plants can be grown, the excess of soluble salts must be removed by repeated washings with fresh water. In Holland this has been necessary with soils reclaimed from the sea.

Thus in the scheme of things, what is now covered with water will someday be land, even as much of the land exposed at present was at one time the bottom of a sea. Oceans follow oceans. The salts accumulating in oceans to-day will furnish sustenance to land plants and animals of future ages. This continuous, cyclic drama has been effectively described by a poet in the following way:

"The old order changeth,
And God fulfills himself in many ways,
Lest one good custom should corrupt the whole."

GETTING THE MOST OUT OF YOUR

LEGUME SEEDS

ALFALFA • ALSIKE • RED CLOVER

MINNESOTA research men report alfalfa seed production has been increased to as much as 760 pounds per acre by the use of good management methods, including fertilizer—nearly 18 times the state average of 49 pounds per acre.

The research men list three essentials for getting good seed production for legume crops: 1—Effective pollination; 2—Control of harmful insects; 3—A good fertilizer program.

In experiments with seed crops of alfalfa, alsike, and red clover in Northern Minnesota, the agronomists, entomologists, and soils specialists used various rates and methods of insect control, pollination, and fertilization. They have found a combination of all these practices produces the best results.

The research men used 1,000 pounds per acre of a phosphate-potash fertilizer and sprayed the plots with DDT and toxaphene before pollination.

In the tests, yields of red clover seed ran as high as 700 pounds per acre, compared to a state average of 59 pounds. Alsike clover seed production reached 808 pounds, or nearly eight times more than the Minnesota state average of 114 pounds per acre.

In addition to fertilization and insect control, the research men found it is essential for legume plants to be disease-free so that flowers will mature. They also report it takes good general management to bring the legume crop into flower at the right time of the season.

FOR BETTER SOILS

FERTILEGRAMS

TESTS at the Ohio Agricultural Experiment Station, Wooster, show that plowing down part of the fertilizer for late potatoes is fully as effective as applying all of it along the rows.

Horticulturist John Bushnell who made the tests reports that a 3-season average yield for plowed-down applications was 385 bushels per acre compared to 382 bushels from row applications. Soil in the Station test plots was Wooster silt loam.

Earlier Ohio experiments have shown that some fertilizer is needed near the row to insure rapid growth of young plants at the start. Bushnell noted little difference between applying one third or two thirds of a 1500-pound per acre rate as a plow-down application and the remainder along the row.

There were no differences in emergence of the young plants, nor in their growth and appearance during the season. Time of maturity was similar in the dry years of 1953 and 1954.

But in 1955 with six inches of rain in July, there were some differences between the two methods. In plots where one half or two thirds of the fertilizer was plowed down, plants died down a week earlier than in plots where all the fertilizer was applied along the rows. Yield and quality, however, were similar in both cases.

Most North Carolina soils need more lime, soil tests show. Bill White, soils specialist for the N. C. Agricultural Extension Service, reports almost every acre of cultivated land in the Tar Heel state needs at least one thousand pounds of lime.

Figured on the basis of the average size farm in North Carolina, every farm needs 15 tons of lime applied to the total crop land to maintain the correct degree of acidity, White says.

Will it pay to apply needed lime? It most certainly will, according to White. He says results of recent tests show that where lime was applied to acid soils the extra yields gave a net return of from $10 to $40 for each one dollar spent for lime.

It is more profitable to fertilize alfalfa every year than to apply fertilizer every second year, according to Soils Scientist J. M. MacGregor of the University of Minnesota. In tests conducted since 1951, he found that annual fertilizing brought $7.80 more net profit per acre than did biennial fertilizing. Also, in tests where no fertilizer was used, MacGregor found that annual fertilizing resulted in $20.20 more net profit per acre, while biennial fertilizing brought $12.76 per acre higher net gain.

A 1950 fertilizer demonstration is still showing the carryover value of plant food treatments, according to Ray Graham, county agent of Lawrence County, Missouri.

Seven years ago a strip of a cucumber field on J. H. Glasscock's farm near Miller in Lawrence County was fertilized for maximum production. The remaining portion of the field was fertilized at a lesser rate.

Graham says he visited the field—now seeded to lespedeza—recently and that the strip fertilized heavily in 1950 produced 50 percent more hay per acre than the remainder of the field.

During the intervening seven years the entire field has been limed and fertilized alike but the effect of the heavy use of fertilizer is still apparent. And, according to Glasscock, the strip has outyielded

FROM ACROSS THE LAND

FOR BETTER CROPS

the remainder of the field each of the past seven years.

Not only was the yield greater on the strip fertilized for maximum production but it was freer of weeds and the lespedeza was a darker green than was the remainder of the field.

Peach growers of South Carolina are being urged to combine two important fall practices in their orchard work this fall—planting fall cover crops and proper fertilization.

Roy J. Ferree, leader, Clemson Extension Horticulture Work, says, "The planting of winter cover crops along with proper fall fertilization is a most important combination of practices for commercial peach orchards. Erosion is taking a heavy toll in many orchards of the state. Not only is a large percent of the fertilizer applied being leached out of the soil but the best topsoil is also being washed away, particularly in Piedmont orchards. The fact that yields of fruit per acre on these eroded hills are the lowest in the state should be an incentive to the growers to carry out practices to conserve soil and fertilizer to improve their yields."

He suggests applying from 400 to 600 pounds of 4-8-12 or 4-12-12 fertilizer per acre at the time of seeding. Winter cover crops which may be planted alone or as mixtures include rye, oats, wheat, barley, Dixie Wonder or Austrian winter peas, vetch (common or hairy), and crimson clover.

Dew is an important source of moisture for Midwest crops. The U. S. Department of Agriculture says that in Ohio tests, dew accumulation amounted to 10 inches of moisture during a year. Some years this amounts to 20 per cent of the total water supply for the crop.

Fertilizers have increased stands and yields of crops at the Kansas State College sandyland experiment field near St. John, according to Marvin Lundquist, superintendent.

Grain sorghums this year responded well to nitrogen and did still better when phosphorus and potash were added. From observation of his grain sorghum fertility plots, Lundquist estimated that the plots which received all three have been two to three weeks ahead of the plots getting no fertilizer. From past results the application of 40 pounds of each nitrogen, phosphorus and potash have been the most economical on sandyland. Applications at the time of seeding were most beneficial as they promoted earlier growth, he added.

By 1975 it is estimated that 10 to 12 million tons of fertilizer will be used as plant nutrients. That would be an increase of 75 to 100 per cent over the amount used in the country today, reports the U. S. Department of Agriculture.

The great majority of Georgia farmers are working "blindfolded" on unfamiliar ground, according to agronomists of the Agricultural Extension Service, University of Georgia College of Agriculture. They are planting and fertilizing their fields without first determining the soil's fertility by soil testing.

Agronomists Jim Bergeaux and Ralph Wehunt reported that during 1956 only 21,213 soil samples were analyzed by the soil testing laboratories in the state. "These samples represent only five percent of the farms in Georgia," they declared.

Soil testing is the foundation of a good fertility program—pointing the way to high per-acre yields.

Abstracts

1102 16th STREET, N. W. WASHINGTON, D. C.

FROM THE AMERICAN POTASH INSTITUTE LIBRARY SERVICES

Through its library, the American Potash Institute summarizes the important findings on the role of potash in good soil management and balanced soil fertility. This program abstracts the important potash information from each article that is summarized. These abstracts are available on request to professional agricultural workers of the United States and Canada. Each issue *Better Crops* features a small portion of the abstracts available in current issues. If you are interested in receiving this summary service regularly in complete issues, please write the above address.

Beans—K-Amount in Crop

Fleming, J. W.

Factors influencing the mineral content of snap beans, cabbage, and sweet potatoes. Ark. Agr. Exp. Sta. Bul. 575, 14 p. June 1956.

The results of 3 greenhouse and 2 field exps. are presented to show the effect of appln. of K, Ca, and P on the uptake of these elements by beans, cabbage and sweet potatoes. The plant content of each element studied varied widely between exps. The lowest and highest values, in percentage of dry matter, for each element in bean pods were: K, 1.86 and 3.10; Ca, 0.101 and 0.525; and P, 0.295 and 0.739. Increasing concns. of K, Ca and P in nutrient soln, increased the content of the resp. nutrients in the bean pods, tops, and roots. The Ca content of the bean tops decreased with increasing concns. of K in the nutrient soln. Potassium and P applns. to the soil in field exps. increased the percentage of the resp. nutrients in bean pods, cabbage and sweet potato storage roots. At the levels used, Ca, K, and P applied to the soil in field exps. had no influence on the Ca content of bean pods, cabbage or sweet potato storage roots.

Coile, T. S.

Soil and the growth of forests. Advances in Agronomy 4:339-340. 1952.

Studies were made on the effects of various applications of mineral fertilizer on the growth of red pine. The following applications were made: 500 lb. 5-10-5, 100 lb. ammonium sulfate, 500 lb. calcium oxide, 200 lb. KCl, 200 lb. tricalcium phosphate, and 300 lb. sodium nitrate. Increase in tree vigor and response in height occurred only in treatments containing K and Na. The entire expt. was repeated in 1946 with increased amounts applied and with K_2SO_4 added. Results again indicated marked growth response to K. The effect of fertilization on K content of the youngest foliage (one-yr.-old) and growth of the trees was still evident after 16 years.

Rice—K-Effect on Quality

Beacher, R. L.

Rice fertilizer tests, 1954-1955. Ark. Agr. Exp. Sta. Mimeo. Series 46, p. 3-6, 8, 10-12. April 1956.

Liquid 8-8-8 fert. increased rice yields significantly when applied in irrigation water. The increases were attributed mainly to the N in the 8-8-8. Tests on outlying farms indicated considerable variation in degree of response among the different farms. At the relatively high rates of N use, it appeared that K additions increased straw growth while P additions decreased it.

Control of tree diseases involves several factors. Ohio A.E.S. Ann. Rept. 1937-38, p. 25. Feb. 1939. (Wooster Bul. 600). Dept. Bot. & Plant Path.

Verticillium diseases of elms and maples can be fairly well controlled by cultural practices especially by proper feeding; careful pruning of diseased parts and then proper feeding with 10-6-4 to build up vigor will generally control the disease.

Heiberg, S. O. and White, D. P.

Potassium deficiency of reforested pine and spruce stands in Northern New York. Soil Sci. Soc. of Amer. Proc. 15:369-376. 1950. Also in Better Crops with Plant Food 36(10):17-22, 46-50. Dec. 1952.

Serious nutrient deficiencies that may be encountered under certain ecological conditions in connection with the re-establishment of forests on old fields in N.Y. were investigated. It was demonstrated that these deficiencies could be corrected, at least in part, by applications of forest debris, forest humus, and K_2O fertilizers. In addition some light is thrown on certain aspects of nutrition of some tree species commonly used for reforestation.

Wilde, S. A. et al.

Effect of high rate fertilizer treatments of nursery stock upon its survival and growth in the field. Jr. Forestry 38:10, p. 806-809. 1940. *Abs.* E.S.R. 84:479. 1941.

The application by broadcasting or in solution of a balanced NPK fertilizer to nursery beds of average fertility resulted in an average increase in survival from 10 to 15 per cent following transplanting of 2-year-old jack, red, and Scotch pine seedlings to a podzolic outwash sandy loam. However, no statistical significance could be attached to survival data because of the variability among individual sample plots. The average increase in height growth ranged from 20 to 30 per cent in favor of the fertilized stock and was found statistically significant. A seasonal effect was evident, with spring planting giving somewhat better survival and height growth than did fall planting.

Shcherbakov, A. P. and Mishustin, E. N.

Fertilizing conditions as a means of accelerating the growth of oak seedlings and the development of the mycorhiza on their roots. Agrobiologiya 5:121-127. 1950; Chem. Zentr. 1951, II, 440. *Abs.* C.A. 48(16):9601. 1954.

Fertilizing with phosphates accelerated the growth of oak seedlings. N and K also had a beneficial effect. Fertilizing with N 20, P_2O_5 180, and K_2O 30 kg. per hectare is recommended.

Trees Respond to Fertilizer

Henderson, W. N.

Fertilizers find market in forests. Journal of Commerce, p. 12. Nov. 20, 1956.

The chemical industry has a new marketing opportunity—fertilizing forests for greater wood production. Research at Washington State has shown that N can increase tree growth by 40 to 65%. Trees fertilized with K_2O by researchers at N.Y. State Univ. registered gains in growth up to double that of unfertilized trees. Complete, N-P-K, fertilizers have also been tested with marked success. Methods of fertilizer application are discussed.

Stone, E. L. Jr.

Magnesium deficiency of some northeastern pines. Soil Sci. Soc. Amer. Proc. 17(3): 297-300. July 1953.

Fertilization of deficient trees with $MgSO_4$ resulted in increased ht. growth over a period of at least 3 yr. In 2 instances, this increase was shown to be additive to that due to K, without evidence of significant interaction. Gross reductions in shoot growth and needle length occurred only under extreme deficiency or when lack of Mg was accompanied by K deficiency.

Walker, L. C.

Foliar analysis as a method of indicating potassium-deficient soils for reforestation. Amer. Soc. Agron. 1953 Ann. Mtg., Abs. of Papers, p. 70. Nov. 1953.

Foliar anal., including chem. determinations and observations of abnormal colorations, is useful in diagnosing levels of K in soils of abandoned lands suspected of being deficient in available K for normal growth of certain conifers. Foliage of 18 species of native vegetation in 19 locals were sampled in July-Aug. 1952. Plots fertilized with KCl were established and foliage of vegetation growing thereon sampled in order to obtain data for comparison. Results are discussed.

Wenger, K. F.

The effect of fertilization and injury on the cone and seed production of loblolly pine seed trees. Jour. Forest. 51(8):570-573. 1953. *Abs.* Biol. Abs. 28(3):6842. Mar. 1954.

Following a seed tree cutting, 25 isolated seed trees in ea. of 2 locations were treated in 1 of following ways: no treatment; knife-cut halfway around stems; 25 lb. 7-7-7 fert. per tree; and 50 lb. 7-7-7 fert. per tree. In the 25-yr.-old stand lightly fertilized trees produced 98 cones and heavily fertilized trees 123 cones per tree in 1st effective yr. (3d growing season after treatment), compared to 36 cones per untreated tree. Dif. between lightly and heavily fertilized trees was not significant. Effect of fertilization seemed to depend on age of trees, and also did not carry over to next yr.

White, D. P.

Fertilizing forest trees. Plant Food Review 2(4):6-9. Winter 1956.

There now is ample experimental evidence of the deficiency of N, P, and K and Mg in forest plantations and second growth stands in the U.S. and Canada. Results so far to develop a good appln. method from ground transportable equipment have been disappointing. Aerial appln. techniques are promising but there still is room for improvement. Ground and hand appln. methods are feasible when fertilizing small areas, such as farm woodlots, and isolated block. Finally we need much more growth and yield data as well as economic analysis of the promise of fert. use in forestry, both in terms of present and future values.

The little girl demurred at taking the dose of medicine which her parsimonious Dad offered. "Come now, your old Dad spent his last dollar for this," he pleaded.

The child took the medicine, but a little later she sidled up to him and said, "Daddy, if you think you can afford it, I'd like to frow this up."

• • •

A woman got on the train with nine children, and when the conductor came for her tickets she said, "Now these three are 13 years old and pay full fare, but those three over there are only 6, and these here are 4½."

The conductor looked at her in astonishment. "Do you mean to tell me you get three every time?" he asked.

"Oh, no," she said, "sometimes we don't get any at all."

• • •

The elderly spinster was describing her car troubles to the mechanic: "The battery won't bat, the spark-plugs won't spark, the crank-shaft won't crank, and the pistons—well, they don't work either!"

• • •

The Scotchman sent an indignant letter to the editor of the newspaper. He said that if any more stories about stingy Scotchmen appeared in the columns, he was going to stop borrowing the paper.

• • •

At a dinner party, Jones was so shy and nervous that he couldn't talk to anyone. All evening long, he had been trying to think of something nice to say to the hostess.

At last, seeking to draw him out, the hostess remarked, "What a small appetite you have, Mr. Jones."

"To sit next to you," said Jones, gallantly, "would cause any man to lose his appetite."

• • •

Two old mountaineers, sitting on a cabin porch were examining an ancient armspiece.

"Good shot gun that," said the owner, patting the rusty relic. "It's killed possum, coon, wild turkey, and squirrels. What's more," he added under his breath, "it got me two sons-in-law."

• • •

The kindly old lady had made a pair of pajamas for the Red Cross to give to some soldier. The Red Cross worker looked at the handsome clothing and noticed that the pants had no front opening. Gently the situation was explained to the donor. The little old lady was downcast at first but then she brightened up. "I have it; give them to some bachelor," she murmured sweetly.

The reason most women pay more attention to beauty than brains is that no matter how stupid a man may be, he is seldom blind.

Borate your Fertilizers

FOR CUSTOMERS IN THE AREAS SHOWN

for Insurance

SUPPLY REQUIRED BORON...

for Economy

CHOOSE FERTILIZER BORATE... THE MOST ECONOMICAL SOURCE OF BORON...

For quality, yield and stands of...

FIELD CROPS
Alfalfa, clovers, cotton, tobacco, etc.

FRUITS AND NUTS
Apples, citrus, pears, nuts, etc.

TRUCK AND VEGETABLES
Beets, broccoli, celery, cauliflower, etc.

For...

1. Complete Fertilizers
2. Granulated Fertilizers
3. Granular Blends
4. Liquid Fertilizers
5. Borated Gypsum and other Fertilizer Materials

Plant Food Department Offices

AUBURN, ALA.
First National Bank Bldg.
COLUMBIA, MO.
P.O. Box 236
KNOXVILLE, TENN.
6105 Kaywood Drive
PORTLAND, OREGON
1504 N.W. Johnson St.

United States Borax & Chemical Corporation
PACIFIC COAST BORAX COMPANY DIVISION
630 SHATTO PLACE, LOS ANGELES 5, CALIFORNIA
100 PARK AVENUE, NEW YORK CITY, NEW YORK

EDUCATIONAL SERVICES

K_2O

AMERICAN POTASH INSTITUTE

SLIDE SET SERVICE

For graphic instruction . . .

. . . four sets of color slides with scripts are available for classroom teaching, club meetings, community demonstrations, etc. Write Slide Set Service at the address below for all four sets or any of the four described here:

SUCCESSFUL ALFALFA

Featuring steps necessary to grow alfalfa successfully . . . and profitably. ($4.00)

SOIL FERTILITY & SOYBEANS

New concepts of producing soybeans, covering all phases of production. ($4.20)

POTASSIUM HUNGER SIGNS

Deficiency symptoms on our major crops and effects of potassium hunger. ($2.20)

POTASH PRODUCTION

Vivid slides on mining and refining processes used by the potash industry. ($6.00)

For Sale. For loan: ten days. Scripts included with sets. Available as film strips, also.

Better Crops with PLANT FOOD

IF NOT DELIVERED, return to

AMERICAN POTASH INSTITUTE, INC.
1102—16th St., N. W., Washington 6, D. C.
RETURN POSTAGE GUARANTEED

Bulk Rate
U. S. POSTAGE
PAID
Washington, D. C.
Permit No. 2283